DOCUMENT RESUME

ED 188 824 RC 012 093

AUTHOR Kudlas, John
TITLE The Rock Climbing Teaching Guide.
INSTITUTION American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD).
PUB DATE 79
NOTE 112p.: Not available in paper copy due to publisher's preference.
AVAILABLE FROM American Alliance for Health, Physical Education, Recreation, and Dance, 1201 Sixteenth Street, N.W., Washington, DC 20036 ($6.95)

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS *Adventure Education: *Course Content: Course Objectives: Educational Philosophy: Environmental Education: *Equipment: Experiential Learning: Illustrations: *Outdoor Education: *Safety Education: Secondary Education: Self Concept: Skill Development: *Teaching Guides
IDENTIFIERS *Rock Climbing

ABSTRACT

The product of 10 years of rock climbing instruction, this guide provides material from which an instructor can teach basic climbing concepts and safety skills as well as conduct a safe, enjoyable rock climbing class in a high school setting. It is designed for an instructor with limited experience in climbing: however, the need for teacher enthusiasm and patience is emphasized. Also accented are the positive aspects of psychological and physical skill development. For instance, rock climbing can provide a moderate amount of stress which can lead to personal insight and promote self-confidence. Safety aspects are dealt with in depth, emphasizing "why" something has to be done. Equipment needs and care are discussed in terms of both school budgets and safety. The 13-session course includes 1 class on the "Three-Point Rule" which requires students to crawl or walk while moving only 1 limb at a time. Each class session has a seven-point format. This guide also includes a long segment on constructing artificial climbing walls to provide experience in any locale. (AN)

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THE ROCK CLIMBING TEACHING GUIDE

JOHN KUDLAS

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THE ROCK CLIMBING TEACHING GUIDE

by

JOHN KUDILAS

AND ILLUSTRATED by Ed Johnson

To Mom and Dad Vanderhoof

Who Belayed Me Well

and

Encouraged Me to Climb Higher

Without My Getting Too Aloft

Masculine nouns and pronouns are used in this Guide for both sexes.

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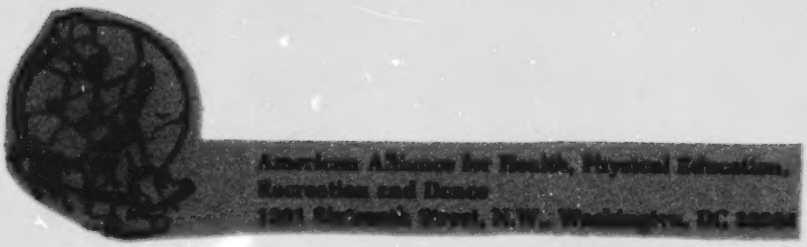

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PREFACE

The exodus of the many people, especially young people, to the outdoors has offered physical education a new challenge for outdoor leisure education. Rock climbing is only one of the many outdoor activities that can be taught safely within the public schools. This with an air of environmental responsibility.

The enclosed material is the result of 10 years of rock climbing instruction at the high school level with more than 1000 students receiving instruction. This, in addition to the many state and national teacher workshops I've conducted over the past several years. Instruction, such as this, based on simplicity has proven to be safe. With this safety in mind, I've attempted to make this material simple, easy to understand, and functional. It is my hope that this material will be used in its entirety and considered a total program. That is, the total instructional segment should be read before an attempt is made to teach the program. This will help develop the attitude necessary to successfully and safely teach the exhilarating sport of rock climbing.

I've also included a segment on artificial climbing walls so that a climbing facility could be constructed to enhance instruction and provide a climbing experience, regardless of your locale. Here, again, you will need to devote extra time and effort to insure a safe climbing facility and successful experiences for students.

Welcome, good luck and good climbing.

ACKNOWLEDGMENTS

I would like to take this opportunity to thank several people for their encouragement, expertise and assistance. Without their help, this manual would not be possible. First, my wife, Donna, for her patience with my projects and willingness to type "just one one more page." Without her smile and support this would have been a much more difficult task. Next, Ed Johnson, a former student of mine who drew all the illustrations. And Mr. Bob Robinson, who was willing to take the time from his busy schedule to proofread this manual. And the many climbers I've had the pleasure to work with, including Bill and Mike Jackson and Dr. Don Deaton. And Dr. Dale Cruse, of the University of Utah, who first gave me the inspiration for this project in his seminar class. Finally, I would like to thank the Rochester Public Schools for the opportunity to develop a climbing program and climbing facilities. All these people should be considered prime contributors to the Rock Climbing Teaching Guide. Thank you all.

INTRODUCTION

Rock climbing is by no means a new sport. Enjoying a heritage that antedates mountaineering, rock climbing was regarded as a healthy sport by the Romans. Emperor Hadrian, for example, climbed up the escarpments of Mount Etna in 104 A.D. In the 14th century, Petrarch often climbed in Provence.

The first climbing school was established at a monastery in France's Dordogne Valley in 1426. In addition, King Charles VIII of France, in 1495, established a climbing school and appointed Jean de Beaupre' as the climbing instructor. In England, John Atkinson, in 1825 devised a method of rock climbing to rescue lost sheep. These latter two men were destined to become the "fathers of rock climbing."

Even though climbing equipment and techniques of the mid-1800's can surely be questioned, this period is referred to as the "golden age of climbing" with many European tourists seeking to reach the summits near Zermatt. The ropes were shorter and made of inferior material such as hemp, flax and cotton. The techniques of "looping the rope" around boulders to anchor climbs and "body arrests" to prevent a partner's fall certainly contributed to the many multiple tragedies.

In the United States, Seattle has led the way in rock climbing, with the first climbing wall constructed in 1941 at the William G. Long Camp. Since 1950, the French have included rock climbing in their curriculum on a limited basis, and a decade later the English began incorporating the sport into many of their elementary and secondary schools.

During the past few years there has been a vast amount of interest in ecology, precipitating the environmental movement and an exodus of adventurous people to the outdoors to discover and investigate more fully and personally nature's wonders. There has been an attempt to affectively feel this phenomena and to cognitively understand it and man's interrelations.

One of the activities that has exploded with its number of participants is the subject of this text--rock climbing. No longer is this invigorating activity limited to a few mountaineers. All age groups and sexes can now participate, depending upon their ability and training. With proper instructions most individuals can reach the emotional fulfillment and "environmental discovery" offered by rock climbing. The goal of this text is to provide the instructor with a guide so that he might better be able to teach these concepts safely and efficiently.

Some public, as well as private, institutions have included rock climbing into their elementary, junior high school, and/or secondary curriculums. Several colleges and universities, as well, have provided climbing instruction. Several outdoor adventure organizations, such as Outward Bound, National Outdoor Leadership School, as well as other spontaneous climbing schools teach indepth courses in rock climbing.

There has been, however, little communication among these groups and each is biased toward its own method of instruction, confusing neophyte instructors at public school levels. However it should be emphasized that many techniques have been developed by these organizations which are safe and successful, the two most important criteria for inclusion of any innovation in climbing. This text will attempt to describe several methods with their advantages and disadvantages in an attempt to provide the instructor with an objective choice. Emphasis will be, however, upon simplicity and safety.

The intent of this text is to provide material from which the instructor could teach basic climbing concepts and safety skills that would enable him to conduct safe and enjoyable rock climbing classes in a school atmosphere. This text is designed for the instructor with limited experience who wishes to teach rock climbing classes. Mountains are not necessary to rock climb, although their presence should be capitalized upon, and any outcropping of hard rock can be utilized.

This guide is not designed to "book-teach" mountaineering from "A to Z." Many texts attempt to do this and many of us have learned via the "book-trial-error" method, which is dangerous at best. This is not to imply that the many fine texts as listed within the bibliography are not useful; they are all excellent resource material, but they are not designed for instruction within the school environment.

Some concepts learned in rock climbing can be applied to many other facets of life. One such concept is the ability to function under stress. Stress is when there is sufficient apprehension on the part of the participant to require extraordinary measures to maintain an organized functioning. When in a stressful situation, the climber has an opportunity to re-evaluate and discover himself and his potentialities. This process can be utilized in everyday life. Some studies have revealed the potential importance of rock climbing:

Smith's study of the Outward Bound Program, although more than a rock climbing course, showed a positive impact on the participants' self-esteem.

Davis discovered that overcoming fear during rock climbing resulted in new levels of self-awareness and self-confidence. He noted, however, that the fear must be overcome and transformed into enthusiasm before self-awareness and self-actualization would occur.

There have been many studies conducted relative to the effects of outdoor adventure programs, but few limited to rock climbing. Research is desperately needed in this area.

PHILOSOPHY

To engage in a rock climbing endeavor necessitates making some serious decisions. It has been this author's experience that it is much easier, more functional and safer to teach a few concepts well than many superficially. That is, it is safer and less complicated to know two or three basic knots well than many vaguely. Time is always a problem in conducting a course like rock climbing, which requires flexibility within the structured framework of a school day. The teaching rate can only be as fast as the individual student's assimilation; the instruction must be "open-ended" to provide additional challenge for the accelerated student as well as additional assistance for less skilled participants. Success of any program will be proportional to the enthusiasm of the instructor. This is not only true of rock climbing instruction, but of all areas of education. Hence, the prerequisite for such a task is teacher enthusiasm.

OBJECTIVES

The readers should evaluate their motivations for reading this text. True introspection will reveal if they should proceed with actively teaching rock climbing, or if they should continue with more familiar teaching endeavors. That is, is rock climbing the vogue thing to do or does it offer meaningful experiences for students? If the movement of activities to the outdoors is simply the "in" thing to do, then perhaps the efforts of the reader and subsequent financial support by the institution might better be allocated elsewhere.

Let's examine possible psychological and physical skills concepts learned through rock climbing. Concepts, for our purposes, are ideas the participant might apply to other activities of life. It has been the author's experience that climbing does contribute to the realization of these concepts to varying degrees.

Psychological Concepts

1. Develop moderate amounts of stress to gain insight about oneself and others. Moderate amounts of stress encourage self-evaluation and the reappraisal of relationships with others. Hence, a certain amount of adverse stimuli functions as an aid for an individual to reach the "homeostatic" state with his environment.
2. Overcoming fear opens horizons for new learning. Golant and Burton, in a survey study, found that most people avoided environments in which they had no experience with its possible hazards; people are afraid of the unknown. People who come through the fear may lessen their perception of vulnerability.
3. Developing self-confidence is possible by overcoming personal fear. This was one of the conclusions as brought forth by the Davis (previously mentioned) study.
4. Self-concepts can be improved through new outdoor discoveries. Koepke discovered that 44 participants' self concepts improved and they

viewed themselves more positively after the Colorado Outward Bound experience.

In terms of life-time contributions, rock climbing will benefit students according to specific criterion tasks:

1. In situations of vocational/avocational uses of the outdoor environment, the student will be able to identify appropriate and inappropriate actions and indicate their responsibility in the situation based upon personal values, safety, alternatives and consequences.
2. In situations of vocational/avocational uses of the outdoor environment, the students will be able to recognize situations in which legal responsibilities which protects the environment will dominate over personal desires.
3. In situations of vocational/avocational uses of the outdoors, the students will be able to enjoy and appreciate the outdoor environment.
4. In situations of vocational/avocational uses of the outdoors, the students will utilize skills which will reflect their positive value and appreciation for the environment, resulting in a minimum of physical impact on the environment.
5. In situations of vocational/avocational uses of the outdoors, the students will be able to identify conflict situations and react under stress using open communication, problem solving skills and share responsibilities.
6. Students will recognize vocational opportunities within the area of the outdoor environment.
7. In situations of vocational/avocational uses of the outdoors, the students will recognize the harmony and the delicate balance of the outdoor world.

Specific Rock Climbing Skill Concepts

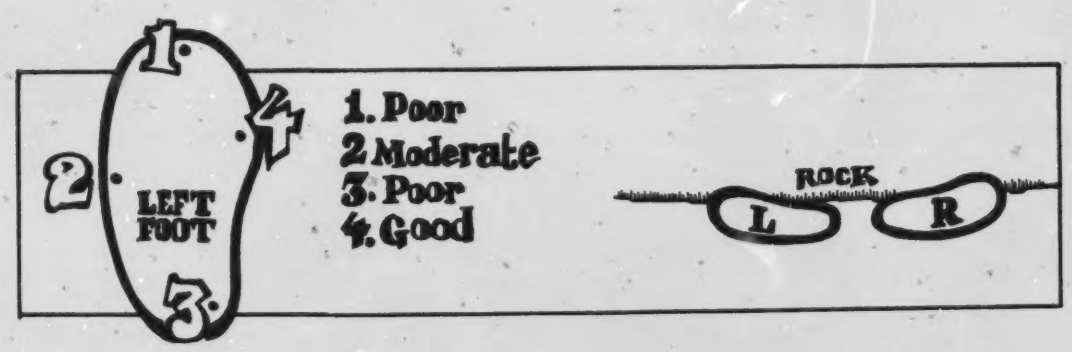
1. Properly learned skills and proper equipment are necessary for safe participation.
2. Conditioning, balance, strength, and logic are necessary for safe and enjoyable participation.
3. Simplicity within a system insures maximum security, less equipment and fewer human errors.
4. A wide base will more securely support the climber. This concept is especially important in preventing the body from pirouetting/twisting from its means of support.
5. Looking down at the feet will reveal more means of support for the legs. Most novice climbers will focus their attention upward at their hands.
6. Security is often procured more easily by directing the upper body weight away from the means of support. The neophyte will attempt to "grasp" the rock face, thereby reducing the angle of his feet on the supportive structure.
7. The more the means of support, the greater the security for the climber. That is, basically the climber has four means of support; two arms and two legs. Climbing necessitates moving these appendages one at

a time in a rhythmical fashion. This is referred to as the "three-point rule." Only one arm or leg is moved at one time, insuring three other points of support. This is especially important for beginners.

8. The larger the muscle group, the more strength and support proved. Simply, the feet and legs offer more support than the hands and arms. A climber can support himself for hours on his feet; but for some people only several seconds by their finger tips. This might seem obvious, but an amazing number of people will attempt to climb using mostly their hands and arms

9. The greater the surface area, the more the support and friction. This concept is important for not only friction climbing, but for hiking and backpacking as well. For any friction movement, particularly on rock slabs, the entire foot should be placed flatly on the rock surface. Standing or walking on the toes will only produce fatigue and falls; using the heel to "hook" tubercles should be discouraged in that it is difficult to "feel" the rock surface from this foot position.

10. Knowledge of anatomy will enhance climbing success. This refers primarily to the foot, in that it is the most used supportive structure. Supporting on the toes, heels, and outside of the foot while face climbing is poor, although there might be times when the climb offers no choice but to use one of these. Because the inside of the feet are strongest and provide most climbing visibility, the weight should be supported in this foot position whenever possible.



SAFETY

It is paramount that all safety concepts, rules, and procedures be strictly taught and adhered to. Before embarking upon the task of teaching rock climbing to beginners, the instructor must ask himself several questions:

1. Are the benefits of the concepts important enough for the students to warrant instructional physical risks for the teacher?
2. Is the instructor willing to teach all the safety aspects as well as all the "fun" concepts?
3. Is the instructor willing to take "total" command of the instruction to insure safety?
4. Is the instructor willing to risk his own safety before taking student risks?
5. Is the instructor willing to spend extra time to inventory and inspect equipment?
6. Is the instructor willing to extend his patience with slower and more cautious students.
7. Finally, does the instructor really want to go through with this?

If the instructor's answers to the above questions are "yes," then he should proceed. This might appear to be a discouraging approach to a new activity, and it possibly is for those who are not fully sincere/ cognizant of rock climbing reality. Obviously, the writer feels strongly concerning the need for these inquiries; however each session necessitates re-evaluation and recommitment. If perchance the instructor reacts negatively, then he should proceed no further in that students' security might be in question.

A poor approach to teaching safety is to sermonize to the students on the opening day of class as to what the rules are. First, they will not be familiar with the equipment and might not even know the names of climbing paraphernalia; hence, confusion will occur. A better approach is to emphasize safety as the students become familiar with the equipment and the concept goals; the students will understand the safety rationale more fully, learn the safety concepts more quickly, and cooperate more effectively. Students are not necessarily interested in "what has to be done," but more interested in "why something has to be done." Therefore demonstrations and a reasoning approach is more functional.

It is imperative that climbing not be taught on a "one-shot" or experiential basis. Several sessions will be required before an actual climb with any degree of exposure is attempted; patience on the part of the instructor is necessary. Before venturing to the outdoors for an "actual" rock climb, all the safety aspects should be well described by the instructor and fully assimilated by the students. Safety must become a teacher and pupil habit.

Maximum security can only be insured by safe equipment, proper instruction, reasonable rules, and safe outing procedures. The presentation of each one of the safety concepts should reveal their importance to class safety.

There are six distinct times when equipment should be checked. This is especially true if other instructors are using the same equipment with other classes. (Specific equipment inspection will be covered later in this manual when equipment per se is discussed.) The first time the equipment should be inspected is when it arrives from the dealer. Make sure all carabiners close and lock securely; ropes have no flaws, cuts or frays; webbing has no flaws, cuts, frays or tape on it. A Minnesota climber was killed recently when the webbing he was using broke at a joint that was taped together at the factory; therefore remove any tape that is not on the ends of the rope/webbing. Next, the equipment should be checked immediately after class use, particularly after an outing. Before leaving on an outing with a class, the equipment should be quickly checked also. Inventory time, or after the season, as well as before beginning anew, necessitates checking. Finally, if any of the gear has received any hard use, such as supporting a climber's fall, then that system should receive careful attention before being used again. If for any reason a piece of equipment is questionable, it should be discarded. The price of equipment can never justify taking unnecessary risks.

A first aid kit is standard equipment for any unit involving leaving the school campus. Although serious accidents do occur, this text will discuss how to limit their occurrence. Nevertheless, be prepared. Ignoring the possibility will not eliminate the probability. The contents of the first aid kit will not be discussed at this time, but caution should be relayed to the reader, that "stock" first aid kits from drug stores function only in aiding blisters, scratches and minor cuts. A good first aid kit will have to be constructed. Many students have serious allergies that require shots. The instructor should not only be skilled in first aid, but should also learn from a physician how to administer emergency shots. Bee stings can be especially dangerous; the instructor should survey his class before embarking to discover if this potential hazard exists. If so, the antidote should be kept in the first aid kit or with the student! The simplest method to transport a first aid kit is to put it in a day pack and have a reliable student or aide carry the pack.

On an outing, it's most beneficial to have another faculty member with the class in addition to the rock climbing instructor. This will facilitate matters if an accident does occur since someone with authority could help the victim obtain proper care. Seldom is there a problem procuring this type of help. Most faculty members, as well as administrators, welcome the opportunity to participate in the activity.

A helmet for each climber and belayer is imperative. It is equally important the belayer have a helmet in that the belayer will often be showered by pebbles and rocks. If the class has to share helmets, it should be via hand-to-hand passing, and not by tossing. An injury due to a flying helmet surely would be difficult to explain. For that matter, no equipment should be thrown because it could become lost, broken, or cause an injury.

The method of instruction, of course, should always have a tone of

safety. For example, all instruction should be kept simple and easy to understand. There is no need for an instructor to "dazzle" the student with his knowledge; this only confuses and discourages students. This manual will emphasize the concept that simplicity enhances learning and insures safety.

One of the most complicated aspects of this sport is that of knot tying; many people have no concept of "what makes a knot work." There are several things the instructor can do to simplify this task, such as using only one or two types of knots. This could be referred to as the "one-knot system." Next, diagrams help greatly. Thirdly, and as a safety precaution as well, everyone should tie his own knots; this cannot be over-emphasized. The student should be taught to tie a swami belt or a bowline around his own waist without anyone else touching the rope/webbing. Only then will success, pride and security be evident on the face of the student.

The instructor must exercise some logic when progressing with his class, depending upon the locale of instruction. Some areas may offer very little relative to climbing potential; this will necessitate limiting the instruction to match the area. Very soft, sedimentary rock areas will not offer much safe climbing, hence the emphasis in these areas should be upon rappeling, knots, and rope techniques. Seldom is this the case since careful inspection will reveal a safe area for climbing.

It's important, no matter what area is used for instruction, that proper rappeling and climbing procedures and signals are used. Each student should be individually checked to insure safety. Without proper communication, climbing will be confusing, discouraging, and dangerous. The proper procedures and signals will be detailed later. It is only mentioned now because of its safety implication.

Because climbing is a decision-making process, the student should be the one who makes the decision whether to climb/rappel or not. No method of coercion or force will make a climber of an individual; many students require additional time for introspection before attempting to climb/rappel. Teacher patience is a prime importance; allowing students to think things out and review their own motivations will build the students' character more than forcing them to climb/rappel. The psychological concepts sought should be instilled in the mind of the instructor. Related to this is the problem of "over-teaching" or "over-coaching" the student. Often, the instructor is overly intent on providing success for the student and insists on telling the student where to place each hand and foot as the student progresses up the obstacle. Again, the teacher would be making all the decisions. When a "top rope" (that will be discussed later) is used and the student loses his support, the fall will only be about two feet. This "fall" and recovery will provide more instruction than an entire session of verbal commands. Students' decisions will result in improved self-awareness.

For safety sake, the area to be visited by a climbing class should

come under close scrutiny. One approach an instructor might use is to carefully analyze a topographical map and determine how far from the institution the climbing facility is, how long it will take to reach the area, the potential hazards of the area, and climbing variety of the area. Obviously, the instructor will have to pre-visit and pre-climb the area to fully understand any possible problems. Often the most dangerous aspect of any climb is the bus/car ride to that area; every effort should be made to reduce highway travel time.

Bus transportation is always the safest and easiest in terms of maintaining supervision and is least susceptible to liability problems. The cost is more, of course, but the advantages of safety, supervision, and legality always should supersede costs. Regardless of who owns the climbing area, permission should be procured. If perchance this area is located upon school, city, state, or federal property, there is generally little problem locating the proper official and obtaining permission. However, on private property the problem becomes more complex. To discover who owns the property might necessitate a trip to the county court house and an investigation of the plat books to find the owner. Once this is done, a personal visit with that owner will be necessary. All property rights should be honored. Therefore, if the owner's response is negative, another area will have to be used. Students' insurance should be checked since fully insured students (either by their parents or by the institution) will increase the chances of obtaining permission to climb on private property.

It is imperative that somebody know where the climbing is taking place; perferably some form of authority. If the climbing class is venturing to an area under the jurisdiction of the city, state or federal authority, contact should be made with them concerning the approximate time of participation, the exact area, and what precautions have been made. Although telephone and personal contacts are good, it's best to send them a stamped form letter which is to be signed and returned indicating that permission to climb in that area has been procured. On private property, the same procedure might be followed, except more personal contact and emphasis upon insurance might be made. Students should be instructed not to frequent private areas which are used for class use. Explaining that this extracurricular activity might jeopardize future class use will usually discourage unauthorized climbing.

Some authority at the institution should also be aware of the climbing class' locale. This might be the department chairperson, principal or dean. This might be important if there is a bus breakdown, inclement weather, or some form of emergency message communiqué. With students below the legal adult age, a permission slip from home to be signed by the parent and returned by the student is important. This does not relinquish the school's legal responsibility, but does provide the parent with important information relative to time, place, type of activity, preparedness, and safety procedures of the outing. The permission form should include a telephone number and time of day when the instructor can be reached for questions. This process also has the positive effect of stimulating parental interest. (See Appendix, page 97.)

Weather often dictates the climbing activity. An alternate activity should be prepared in case of inclement weather. This might be a film, slides, video tape, new knots or something enhancing rock climbing other than actual outdoor climbing. The most dangerous weather factor is lightning; under no circumstances should a class be climbing during a lightning storm; the first sight of lightning should terminate further climbing plans. In a light drizzle some climbing can be accomplished if the students are prepared with rain gear. Remember that rain will act as a lubricant, so climbing will be slippery; be prepared for more potential "falls." The instructor should be aware of illnesses such as frostbite, hypothermia, hypoxia, pulmonary edema, asphyxiation, pulmonary toxemia, sunburn, and dehydration. For classwork, most potential danger results from the occurrence of hypothermia. This occurs when the core body temperature drops due to a lack of insulation, dampness, and insufficient food consumption. The students will need to be reminded to wear warm clothing, hats, and gloves when not climbing. "Shivering" students are showing the first signs of hypothermia and should be attended to immediately by giving them hot liquids and warm insulation.

Attempting to teach climbing in the midwestern "flat" states is a problem and some teachers might be tempted to use limestone quarries. This should be discouraged because many such quarries have deep water in their interior and these present additional hazards. Also, many quarries have been blasted with dynamite and possess many loose rocks that might fall or shower students. Natural outcroppings, cliffs and chimneys are safer since they exist because of their natural hard qualities; these areas should be pursued by the instructor. If quarries must be used, they should be "hard-rock" quarries, such as granite. Dolomite is perhaps the least quality of rock that could be used for class work. Limestone and sandstone should only be used with caution.

There might be other natural hazards about which the instructor should be cognizant, such as snakes and poison ivy. Again, a discussion with an authority familiar with the area will reveal these risks. If these natural hazards do exist, every attempt should be made to avoid them. It is not in the best interest of the environment to attempt to eradicate them in that they fit into the scheme of this habitat. Their presence might require climbing in another area.

In establishing rules for the class, the instructor should remember to rationalize the rules to students. These rules should be safety and logistically-orientated and not for the sake of maintaining authority. Students should be instructed to sit down and await instruction upon reaching the climbing site. Under no circumstances should students be solo climbing/scrambling unprotected. Most students will want to begin climbing immediately; this enthusiasm is good and should be capitalized upon by the instructor. After all, that's the whole idea of the venture. Time can be saved by having people put on their support devices (such as swami belts) while on the bus and by the instructor's assembling the anchors and ropes before the class begins.

For beginners, the "three-point rule" (pages 4-5) should be insisted upon. After several climbs, the students will utilize this safety concept habitually. Students should be on belay, attached to an anchor, or at the security area beyond the climbing vicinity at all times. They should not be climbing without a rope and a trained belayer or standing at the summit/on a ledge without some form of protection.

Permanent, strong, and massive anchors should be used. This might be in the form of a tree, boulder, cemented pipe or some other permanent structure. If not available, then artificial anchors (pitons, nuts, chocks) placed only by the teacher can be used. All anchors should be double checked for stability and support. Familiarity with readily accessible anchors are essential for a safe climbing class.

Top-roping, which is a climbing method that eliminates the hazardous process of lead climbing, should be practiced by a student climber for at least two years before any lead climbing is attempted. The "top-rope" method, if properly used and assembled, will provide safe practice climbing by a class of average students. The wonderful feature of this technique is that students can learn all the psychological and physical concepts without risk. The task of teaching lead climbing is material for another text and will not be discussed here. The mechanics of assembling this type of belay, or the related "over-head belay" will be thoroughly described in the instructional phase of this material.

If students, after being taught, are permitted to place any rigging, such as the top-rope, that rigging should be thoroughly checked by the instructor before its use. The anchor point, it should be reemphasized, is to be only a natural anchor (such as a tree) and not an artificial anchor (such as a piton) for student placement.

Before progressing to the equipment phase of the manual, student "rules" should be reexamined:

1. Solo climbing and scrambling (without protection) is to be discouraged.
2. Beginners should utilize the three-point rule consistently.
3. All students directly engaged in the activity should be either on belay or anchored at all times.
4. "Natural" anchors are to be used as much as possible.
5. Top-roping/over-head belay are to be used exclusively for the first two years of instruction. Lead climbing by the students is to be discouraged.
6. Any student assembled anchors should be double-checked by the instructor. Only "natural" anchors are to be used by students.

EQUIPMENT NEEDS AND CARE

Normally any institution is plagued with the problem of a fixed budget. Therefore, the climbing instructor will have to justify the equipment he purchases as being absolutely necessary. There are many pieces of equipment that are expensive and too sophisticated for a class of beginners; remembering that simplicity enhances learning will also aid in coping with the budget limitations. Caution should be exercised in purchasing anchors; there will be little need for many anchors, hammers, and jumars at the beginning levels of climbing. It would be more functional to purchase more "basic" equipment initially and add more advanced equipment later. The general trend is to hastily purchase several useless "gadgets" rather than many of the badly needed essentials.

It is also difficult to dictate to pupils what apparel to wear while climbing. The upper-body clothing, however, should be tight; this is to prevent any clothing from getting entangled into the rappeling mechanism. The lower-body clothing should be loose to enable the student to stretch. Levis are very poor for climbing unless they are several sizes too large; cut off jeans work well. Shoes should have a very narrow welt; climbing boots would be ideal, but are expensive. Tennis shoes can be used, but do not last long. Boots/shoes with wide welts will displace the person farther from the means of support, thus the narrow-welted foot gear is advantageous (figure 1).

Figure 1: Indicating the importance of narrow welted boots/shoes.

After the equipment has been procured, the instructor is delegated the responsibility of maintaining the equipment. This will be important in providing adequate amounts of equipment for future classes and keeping the gear functionally safe. All equipment should be marked with an identifiable school mark (or name), the date of purchase, and a number indicating the sequence in which it was purchased. For example, carabiners might be marked near the trade name with: U. of U./77/1. This would indicate that the carabiner was the property of the University of Utah, purchased in 1977, and was the first carabiner unpacked in 1977. The succeeding carabiners would be marked, using an electric engraver, in order of unpacking as: U. of U./77/2, U. of U./77/3 and so on. This process not only provides ownership information, but also is a "running" inventory and provides mortality information about the equipment. Felt tip marks and paint do not work well on metal gear because they tend to rub off the aluminum easily. Ropes are generally marked with coded tape on the ends which tell when they were purchased. Webbing should be purchased in bright colors and marked, using a felt marking pen, utilizing the same scheme as with the aluminum equipment.

An inventory sheet, resembling this form, is necessary to supervise equipment:

School:_____ Inventory Personnel:_____

Date:_____

Equipment	Manufacturer	Condition Ex. Good Poor	On Hand Total	Needed Total	Order Recommendation

Assessment of equipment in the field can be acutely difficult, particularly if the instructor attempts to count and check the equipment personally. The solution is simple: by forming a loop of one inch nylon webbing affixed with a tag, indicating the proper count of specific equipment, a student can collect and secure equipment efficiently. Brake bars are normally collected in a marked nylon sack indicating the proper count. Two students can coil and maintain one rope easily. Hence most members of the class have an individual equipment assignment. This delegates responsibility which is important for the success of any cooperative endeavor. To expedite outdoor travel, a rucksack in which all hardware and loops can be stored, should be purchased and marked with the institution's name. Consolidation of equipment simplifies counting, transporting, and maintaining equipment.

The rope is the most basic piece of equipment and should be the first purchased. Ropes may be purchased that are manufactured in two basic styles:

Twisted nylon, which is commonly called by the trade name "Gold-Line," is the less expensive type and, until broken in, resists easy unraveling. The Kermantle rope is superior in its ability to stretch and in handling; however it is more expensive. The fibers of this nylon rope are straight and covered, hence no coiling or uncoiling problems occur. Generally the rope is a 7/16" or 11mm diameter. For class climbing the rope length should be three times the height of the practice climbs, however the rope length should not exceed 150 feet. That is, if the pitch of the climb is 50', then the length of the rope should be 150'. This will provide enough rope for the "top-roping" procedure plus an anchor for the belayer. This will be outlined more clearly in the teaching progression. Enough rope should be provided for each climbing station, not to exceed seven; ideally, one rope for every three students will provide maximum activity. Care needs to be taken in purchasing rope because there are several "off brands" that do not provide the necessary strength. Insist upon Gold-Line/Kernmantle rope. Be wary of any cheap and limp Gold-Line type of rope.

Next, enough one-inch nylon webbing material will need to be purchased to provide for swami belts, seat slings and loops for a class. Slings and swami belts will require about 20' for each student (40 total feet), loops (runners) require about five feet each. Swami and sling belts are support devices which are comfortable to wear for climbing and rappeling. Loops are used over rock horns, around trees, and chockstones as points of security. Loops also are used to store and transport carabiners.

Probably the most expensive equipment necessary will be the carabiners which are either made of aluminum or steel and are manufactured in oval, "D", and locking "D" shapes. Aluminum is the most desirable carabiner material due to its lighter weight. Although there are several brands of these attachment devices, the S.M.C. and Eiger brands are most prized for their dependability. For maximum efficiency a typical class will require two oval and one locking carabiner for each climber and three ovals and one locking "D" for each climb.

Brake bars, which are used for controlling descent, have been the subject of much debate. This is primarily due to their habit of opening up when the rope is not placed over them properly; this is another reason for insisting upon belays as a back-up system. If brake bars are used, each student will need one. If the older method of using crossed oval carabiners is used, then four more carabiners for each pupil will need to be purchased. Figure "8" descenders, an innovation, are excellent if used with Kernmantle rope.

Belaying does not require specialized equipment; however, the instructor might seriously consider the Figure "8" descender or the Stitch Belay Plate with Kernmantle rope for the novice since they insure proper

belaying safety. If they are required, one per student or per climb and rappel will be needed. Helmets, at least two for each climbing station, are required, preferably one for each student.

Finally, a first aid kit needs to be prepared. The contents should include the following materials:

Item	Rationale
1. Lightweight, brightly colored, water repellant rucksack that includes the name of the institution, emergency telephone number and list of inventory items	Transport the emergency items easily
2. 3" roll of adhesive tape	Sprains, dressing, patching cloth equipment
3. Band-aids (four-six, 3/4" or 1")	Minor wounds
4. Burn ointment (tube)	Burns, rope burns, sunburns
5. Gauze bandage (2" roll)	Dressing wounds
6. Gauze flats (four, 3" X 3")	Dressing wounds
7. Hand soap	Cleansing wounds
8. Needle-thread (large medium, small)	Slivers, blisters
9. Single edge razor blade	Cutting tape, clothing, shaving hair
10. Moleskin (1"-4")	Blisters
11. Elastic bandages (1"-4")	Sprains, pressure pads, bandaging
12. Rolaid tablets	Heartburn, upset stomach
13. Scissors (small)	Cutting tape, clothing
14. Triangle bandages (one or two)	Arm sling
15. Butterfly bandages	Deep cuts
16. Snakebite kit (Cutter's)	Rattlesnake bites

(First aid kit-cont.)

17.	Thermometer (with case)	Body and water temperatures
18.	Pliers (small needle nose)	Removing needles, fishooks

Optional Other Equipment To Be Considered

19.	Blow-up splints 1-arm, 1-leg	Fractures. These do not work well in the cold.
20.	Space blanket (1)	Emergency shelter
21.	Chemical ice pack	Sprains and minor injuries
22.	Two large garbage bags (heavy gauge)	Hypothermia victims
23.	Coins (dimes, nickles)	Pay telephone calls
24.	Matches (in water-proof container)	For "hypothermia" fires
25.	Water purification tablets	For emergency water
26.	Sierra cup	For heating and drinking water
27.	Swiss Army knife	Has tweezers, awl, saw and cutting blades for many uses

Blisters, a common climbing and backpacking problem.

Below is an inventory list of materials to provide for the instruction of a class of 20. This would be the optimum amount of equipment:

Item	Amount	Cost Each	Cost Total	Comments
Helmets	14	$21.50	$301.00	For seven climbs
Rope	1050'	.35/ft.	$367.50	For seven climbs-Gold-Line
Rucksack	One	$30.00	$ 30.00	Large enough for all gear except ropes. With leather bottom
1" Webbing	935'	1.40/10'	$130.90	Two belts and a loop for each student plus one for each (7) climb
Oval Carabiner	60	$2.85	$171.00	Three for each climber
Locking "D" Carabiners	30	$4.25	$127.50	One for each student and one for each (7) climb
Brake Bars	20	$1.00	$ 20.00	Or three more oval/ student @ $2.35
Figure "8" Descenders	20	$7.50	$150.00	Or Stitch Belays @ $3.75
First Aid Kit	One	$30.00	$ 30.00	
			$1,327.90	

The approximate costs, which do not reflect inflation, might seem awesome; however, there are methods of reducing these costs. By "letting the material out for bid," the cost can be reduced due to the volume and competitive atmosphere. If this is attempted, brand names should be specified. Students might be requested to share some equipment such as the figure "8" descenders; seven would be adequate, thus reducing the cost greatly. Reducing the number of climbs will reduce the total amount of equipment, thus the costs. The fixed items for the class would be the helmets (at least two per climb), ropes (one per climb, two per rappel), rucksack (one for equipment), and first aid kit (one). All others are flexible and can be shared among students; however, it is generally unwise to exchange swami belts and slings because knots would have to be untied and tied, which would be time-consuming and possibly hazardous.

Once the equipment has been procured, care in handling and storage is required. Remember that under normal usage, climbing equipment will last many years. Any faulty equipment, however, should be promptly discarded.

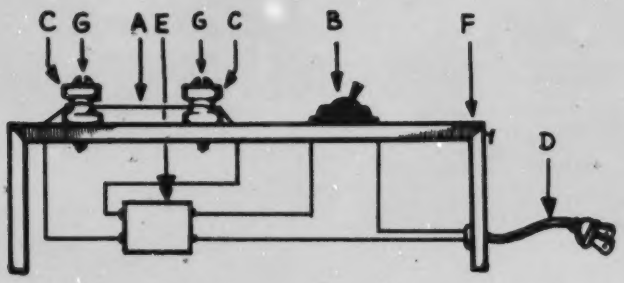
Under no circumstances should improvised or homemade equipment be used.

Equipment purchased in volume is less expensive. With ropes and webbing, this will mean a method for cutting and securing the ends will have to be developed. There are five techniques that might be used to accomplish this task of preventing the ends from fraying.

1. The ends might be simply cut and taped. This is not a desirable technique because the tape will peel off and the rope/webbing will start to fray.
2. The ends may be cut and knotted. This generally holds; however, the knots make tying other knots very difficult and clumsy.
3. Rope ends may be whipped. This works very well, except that it is time-consuming (figure 2).

Figure 2: Whipping the rope with light nylon thread/line.

4. Another technique that works well is to cut the ends, fuse them with some heat source such as a match, lighter or torch, and tape the ends with plastic electrician's tape. Webbing need not be taped if the ends are well fused.
5. Another method is similar to number four, except the heat source is safer and the process is faster. An electrical device, shown on page 19, can be constructed that will cut and melt the ends of the rope/webbing simultaneously; ropes only need an additional wrap of plastic electrical tape to complete the process. All the materials needed are:
   a. Piece of nichrome wire about one-foot long
   b. 110 volt switch.
   c. Two electric fence insulators
   d. Cord and plug
   e. Transformer - either an old electric car or model train version will work well
   f. A box to house the apparatus
   g. Two screws



Ropes are the most important piece of equipment since they link climbers together; normally they will support approximately 4,575 pounds. Therefore, their care should be meticulous in order to maintain this strength. Several very important rules should be thoroughly instilled by the instructor.

1. Ropes should never be walked upon. This might destroy some of the fibers within the rope.
2. Ropes should not be dragged along the ground because rock crystals will work their way into the fibers and cut the small strands of rope.
3. Rope should not be stored near heat or on a sharp hook.
4. Ropes should be kept dry and dried before storing.
5. Ropes should not be kept under tension for long periods of time.
6. Ropes should not be "run" over sharp edges.
7. All knots should be removed before storing a rope.
8. A climbing rope should not be used for any other purpose than for climbing.
9. A rope should be examined after any serious climbing fall.
10. A rope should be examined regularly. Retire the rope if any suspicious frays or bulges appear.
11. A rope should be inspected after being struck by any sizable falling rock.

Washing rope and webbing is recommended to remove the dirt and sharp rock crystals. This may be safely accomplished by using detergent recommended for nylon materials and setting the automatic washer's heat control for "nylon" or "gentle action," then drying in the shade. Direct sunlight over long periods of time, as well as oils, spirits, gasoline, and lacquer thinners, is destructive to nylon.

Care of webbing, because it is made of nylon, also requires a visual

inspection to insure that knots (such as on runners) are well tied, no frays exist, and no tape is present. If a piece of faulty webbing is discovered, it should be cut into small pieces, lest somebody attempts to use it. Nylon is the only acceptable webbing material and no substitutes can functionally be utilized. Cotton webbing looks similar, but will only support about 200 pounds.

Carabiners should "snap" closed without hesitation. If for some reason they become deformed, they will not close properly, thus causing a safety problem. Often carabiners are deformed by individual's hammering on anchors with the carabiner attached; this practice should be discouraged. A carabiner that does not function well should be immediately returned to the manufacturer who generally will replace the item if it hasn't been abused. Another reason for returning a faulty piece of equipment is to enlighten the manufacturer that something might be amiss with the item's design.

Because helmets will be used by several individuals, they should be adjustable and washable. The headgear will become soiled, therefore proper hygiene dictates occasional washing in mild soap. Helmet straps have a habit of wearing out quickly and breaking, therefore the straps should be checked and replaced as needed to keep the helmet on the student's head securely.

Anytime equipment is broken, lost, or stolen, the techniques/methods of the activity should be re-evaluated. Generally, with close investigation, the reason for the broken or missing equipment can be discovered.

COURSE OF STUDY

The neophyte instructor needs to be reminded at this point that progression is contingent upon several limiting factors. This proposed course of study is designed to allow for instructional flexibility in an effort to accommodate these factors. Among these factors are: ability of individuals in the class, area of instruction, amount of equipment, ability of the instructor, class time length, weather conditions and length of unit.

Each daily plan will include certain daily activities that will not be repeated in a redundant manner, but need to be understood. For example, each day should include some form of physical and psychological fitness activities. A review period should also be used daily, not only to reinforce learning but also to enlighten the instructor as to the retention of the class. This also allows the previous day's absentees an opportunity to catch-up.

It should be noted that there is no reason a climbing class cannot function coeducationally. This format has worked well with many age groups, but requires instructional patience. Students who learn quickly need not be bored; they can assist the instructor in teaching the day's task, such as helping teach a new knot to the remainder of the class. Generally, after learning a skill, the student becomes an aid, developing comradeship with others.

The format for the class presentations will be conducted utilizing the following format. However, if the instructor discovers a more efficient sequence/combination, then it should be utilized. There is no secret formula other than enthusiasm, patience and common sense.

1. Objectives and rationale
2. Area
3. Equipment
4. Conditioning exercises
5. Teaching sequence
6. Student evaluation
7. Helpful hints

Session I--Introducing the Unit

1. Objectives and rationale: To introduce the rock climbing unit, a film or a series of slides might be useful. Rules as they pertain should be emphasized, such as dressing properly, being prepared for the activity on time and using rational judgement.

2. Area: Any confined area where the class might feel "together" would be appropriate.

3. Equipment needed as required: Projector and film are usually helpful but most films must be ordered well in advance of the desired showing date.

4. Conditioning exercises: Students usually will not be prepared for physical activity on the first day. However, the instructor should be

explicit in announcing that activities will commence as scheduled.

5. After the film, a question and answer period is recommended. Ignorance is the most dangerous aspect of climbing.

6. Evaluation: The instructor should ask questions to gain an understanding of the students' retention and interest.

7. Hints: Films can be grossly overused. To teach rock climbing necessitates being "on the rocks." One or two films/slide-sets will be adequate; if this is an elective class, the students obviously wish to learn to climb, not watch someone else perform. Any films shown should be in good taste and no attempt should be made to frighten students--perhaps there is enough apprehension already.

Session II--Three-Point Rule

1. Objectives and rationale: Rock climbing requires building a new concept of coordination. The goal is to teach the three-point rule (refer to pages 4-5) and will require the students to learn to crawl and walk while moving only one appendage. This is not easy to do in that most individuals walk/crawl in appendage opposition.

2. Area: Any floor area where the students can "spread out" is adequate. A wall will also be required.

3. Equipment: None.

4. Conditioning exercises: The instructor should be sure the legs, arms and lungs are exercised daily. Running stairs is excellent for climbing preparation for several reasons. First, the students are forced to watch their feet. Next, stair running keeps the runners on their toes, literally, forcing development of the climbing muscles of the lower legs and feet. The concept of "going up" and "coming down" is learned. The increased "up and down" stepping will enhance cardiovascular fitness as well as any other type of running. Stair running for daily exercises will be excellent but the distance and length of exercise time should be at the instructor's discretion and should not exceed five minutes.

5. Sequence: A wrestling mat is ideal for having students crawl on their hands and feet. Care should be taken so as to not rush the students in this elementary activity; students will have to think about doing this. On command they should "crawl" across the mat frontwards, then backwards, followed by sideways. Remember, only one hand or foot moves at a time (figure 3).

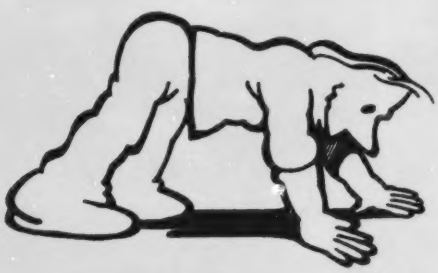


Figure 3: Practicing the three-point rule, moving only one hand or one foot at a time.

After each student has understood this idea, then the wall should be used, attempting to teach the same idea, but in the more traditional climbing position. The students should place their feet as close to the wall as comfortably possible with the toes far apart, heels close together, and both hands touching the wall. Now the students simply "shuffle" along the wall moving only one hand or foot at a time (figure 4).

Figure 4: Rear view of wall position using "three-point rule."

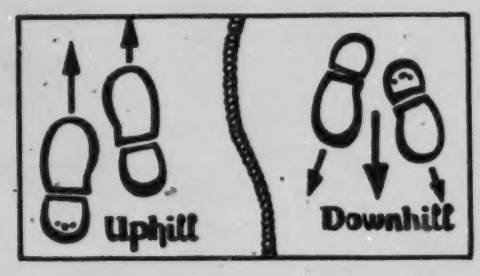
6. Students' evaluation: An instructor might be tempted to allocate more time to evaluation than instruction. Not only is this unfair and unwarranted, but also time-consuming. An easy method to evaluate students in climbing is to have them perform the task, then simply have them record the skill next to their name on the record sheet (page 99).
A score-card (which the instructor would sign) can also be developed. This would also give the instructor a linear idea of how well the individual and class are performing at a glance. This technique will be utilized throughout this course of study.

7. Hints: High school aged students will often (especially boys) feel "silly" walking along the wall. This can be rectified by requiring the student to walk on a 2" X 4" board placed on the floor. This stimulates thought and adds challenge to the task.

Session III--Friction Climbing

1. Objectives and rationale: Introduction to friction climbing, which is one of the "basic" forms of climbing, can now be introduced. This technique allows the climber to walk controlled and freely on angled slabs of rock without the necessity of artificial protection. This skill also develops balance and leg flexibility as well as strength. The feet must remain flat at all times and upon ascending parallel to the "fall-line" of the slope. While descending, the toes are held obliquely outward and the body is squatted down with the arms stretched forward, feet remain flat. Diagramed below are the proper foot positions. The top of

this page is the apex of the slab and the bottom of the page is the base of the hill. Feet are flat at all times for maximum friction.



2. Area: Any hard surface that has a 30^{o} - 60^{o} angle can provide a challenge. The cemented slabs under highway overpasses are excellent, although the danger of traffic might limit their use.

3. Equipment: Helmets and the first aid kit for abrasions are essential.

4. Conditioning exercises: Because time will be a problem, jogging to the area of activity will have to function as the conditioning exercise. The activity of friction climbing will also greatly stimulate the legs.

5. Sequence: Students should be as active as possible and instructed to keep their feet flat at all times, center of gravity low upon descent, not to cross their legs, move slowly, and to sit down upon descent should they lose their balance. If the area permits, mass formations function well although line/squad drills also work. Individual "one at a time" drills should only be used to critique techniques and as a final check. A game of follow-the-leader, with the instructor leading is fun, adventuresome and challenging. Typical skill sequence should be:

a. Up frontwards--feet parallel to fall-line and body erect (figure 5).
b. Down frontwards--toes out, heels close, hands in front, body squatted. Weight back a' la skiing position, allowing the student to "sit-down" should a loss of balance occur (figure 6).
c. Up backwards--foot and body position same as down frontwards (b) above.
d. Down backwards--body and foot positions same as up frontwards (a) above. This technique is seldom used and is awkward. If the group appears to possess below average ability, it is best to eliminate this technique.
e. Traversing--right and left; this skill involves a "shuffling" movement in which the legs do not cross. Generally climbers face

down the slope when traversing, utilizing "down frontwards" movements.

f. Combinations--any combination of a-e listed above.

g. Teacher-led "follow-the-leader."

Figure 5: Proper uphill friction climbing position with feet flat, body erect and arms outstretched forward.

Figure 6: Proper downhill friction climbing position with feet flat and toes out, weight back, knees bent and arms extended forward.

6. Evaluation: Students will self-check each of the movements on their record sheet.

7. Hints: Students should watch their feet at all times, particularly when moving backwards so they are not moving blindly in any direction. Care should be taken that the sloped area is not grassy or sandy since this will increase the number of falls.

Session IV--Equipment Maintenance

1. Objectives and rationale: Introduction and care of equipment is paramount. After this session the students should be responsible for maintaining, securing, counting and packing gear. Time will not allow the instructor to accommodate all these tasks. Responsibility is an integral aspect of climbing; hence, the students need the practice of equipment maintenance, not the instructor.

2. Area: Any area that will allow the ropes to be stretched completely out will serve nicely. When the weather cooperates, this might be accomplished outside on a grassy area under some trees. The instructor should attempt, however, to secure an area where there are not many distractions such as other classes and/or highways.

3. Equipment: All the equipment must be examined. This includes ropes, webbings, loops, brake bars, locking "D" carabiners, and oval carabiners. All items should be inventoried before the first class.

4. Conditioning exercises: Utilization of the stairs can be used once again as well as finger-tip push-ups and overhand pull-ups to develop the arms in preparation for face and jam climbing.

5. Teaching sequence: It's imperative that all class members know how to coil and whip a rope. Save all other aspects of equipment maintenance for another session, if need be, to insure that everyone has an opportunity to coil and whip a rope. A tangled rope is impossible to throw/carry correctly. If a rope is not secured properly, the student should attempt the chore again until success is achieved. It is easier to coil a rope that is stretched out, otherwise it will tend to coil in the same manner in which it left the factory spool. The students might find it more feasible to coil the rope left-handed or twist the rope with the right wrist while coiling it. The instructor needs to continually remind his students about equipment "rules", especially about not walking on the rope and other equipment. The recommended sequence for equipment introduction is:

a. Care and handling of ropes as listed in equipment section.
b. Coiling and whipping the ropes. Loops should be large enough to carry. The simplest method of coiling is shown below (figure 7).

Figure 7: Sequence for coiling the rope.

c. Care and handling of carabiners as recommended in the equipment section. Carabiners should be secured on a loop with a tag attached that will indicate the inventoried number of carabiners.

d. Storage of brake bars for rappelling--stored in a nylon bag with a tag attached that will indicate the inventoried number of brake bars.

e. Method of webbing storage--folded several times and simply tied with an overhand knot and tied together on one loop with a tag indicating the inventoried number of webbing pieces.

f. Introduction of contents of first aid kit and safety rules that might pertain to this area and class activities.
g. Method of packing backpack for storage of all gear except ropes and first aid kit.

6. Evaluation: Students should check the appropriate "box" for completing the rope coiling and webbing tying tasks.

7. Hints: Students should be allowed to make some mistakes and seek help from the instructor or another student. This interaction is gratifying for both individuals. For a rope to be properly coiled, it should be tight with the coils just large enough to fit over one arm and the head. The coil should never be allowed to "drag" on the ground. To handle the equipment pack properly, it should be handled and placed on the back by the lanyard and not by the shoulder straps. The lanyard is closer to the center of gravity and picking up the pack by its strap might result in its accidental removal.

Session V--Basic Knots

1. Objectives and rationale: This session is devoted to the introduction of personal support equipment; basically, tie equipment to themselves. It's essential that each student know the fundamentals of support

systems to provide self/partner protection. A re-emphasis should be made regarding the importance of simplicity. The class could digress to a Boy Scout knot tying class unless the instructor takes necessary precautions. Only two essential knot patterns will be discussed. The first is the simple overhand knot with which most students are familiar and the second is the old, reliable bowline. Knowing these two knot patterns, a climber can protect himself and his party adequately.

The overhand knot (figure 8) is the basic knot upon which the overhand loop, the overhand follow-through and the overhand follow-through "tie-on" are built. The students will be familiar with the overhand knot because they have been using it most of their lives.

Figure 8: The simple overhand knot, the basic knot for building other knots.

The overhand loop (figure 9) is a looped piece of rope which is tied with the same overhand technique as the simple overhand knot. This looped overhand knot is used for attaching students to the rope with a carabiner for fast exchanges of climbs, anchors and rappels.

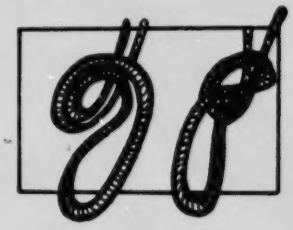


Figure 9: The overhand loop knot.

The overhand follow-through (figure 10) is a very important knot because it is used for tieing the webbing around the climber/belayers' waist. This knot will require more patience due to its apparent difficulty. The knot is based upon the simple overhand knot, which is first tied loosely. Then the other end simply follows where the first end exited. With all ends pulled tightly, the overhand follow-through provides an excellent and secure knot.

Figure 10: The overhand follow-through knot.

The overhand follow-through "tie-on" knot (figure 11) is also based upon the simple overhand knot, but is used for tieing the rope to the webbing, therefore linking the climber/belayers/anchors. To tie this knot, one loosely tied overhand knot is tied about 18" from the end. Then the end is laced around the support webbing, and follows the rope back from where it came. This knot is used to fasten climber/belayers/anchors which are not frequently exchanged. Another advantage to this system is that a carabiner is not used, thereby eliminating the use of an expensive piece of equipment. For students with lesser ability, the "tie-on" method is best because they will be less likely to remove equipment accidentally when they become excited. Nevertheless, this knot is easy to tie, strong, and functional.

Figure 11: The overhand follow-through "tie-on" knot.

The bowline (figure 12) is an ancient knot that was used by Mariners as well as climbers in the past. This knot is important as a means for attaching a rope to one's self or to an object such as a tree or boulder. To tie this knot, the end of the rope is brought around the waist. Then a small loop is made close to the body with the long end of the rope. The short end of the rope, which was brought around the body is placed through this loop; study figure 12 carefully to understand what direction the rope goes through. Pull the short end until the knot is close to the body. There are several "games" which can be used to teach this knot; however, this should be discouraged because the "game" does not work well in the dark or in the reverse position of tieing the bowline around a tree/other anchor. The functional aspect of the bowline is that none of the ends will move and therefore it will not form a slip knot which would "strangle" the falling climber. Obviously, the bowline attachment is economical since no webbing or carabiners are used. However, the knot will have to be tied and retied after each climb/rappel.

Figure 12: The bowline tied around an object.

The secure knot (figure 13) is used for several reasons. First, to keep the bowline and the overhand knots from untieing. Untieing might occur because nylon is very slippery and will tend to loosen after the climber/belayer has walked or climbed a long distance. This is another reason why knots should be frequently checked. The second major reason for a secure knot is to consume all the extra webbing and rope after the bowline or the overhand knot has been tied. This is important because any extra webbing or rope might get caught in the rappelling mechanism while descending or in a crack on the rock surface while climbing. It should be emphasized that the secure knot is only used as a means of securing the major knot and for consuming extra material, not as a means of support.

Figure 13: The secure knot tied after the overhand follow-through.

2. Area: An area where students can converse and discuss knot problems should be used. Again, an outdoor area works well.

3. Equipment: Students are responsible for maintenance of webbing material and ropes.

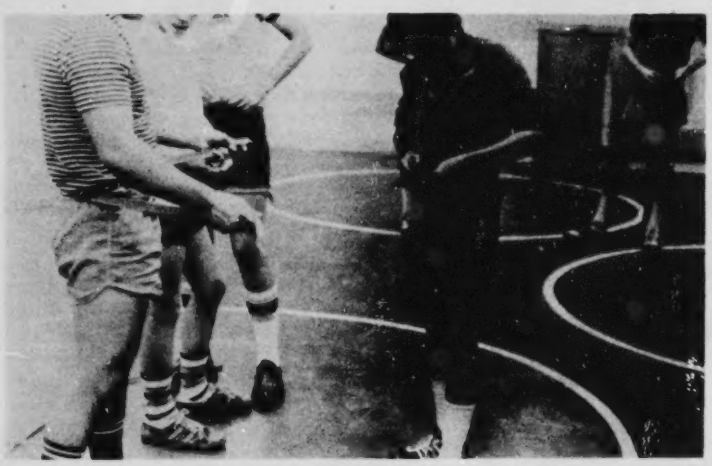
4. Conditioning exercises: On days when no physical climbing takes place, a strenuous workout should be utilized.

5. Sequence: No roped climbing can occur until all students understand and can efficiently tie the bowline and four overhand knot variations. Knots should be taught in the following sequence, using the appropriate equipment:

a. Overhand knot--using webbing or rope
b. Overhand loop--with rope
c. Overhand follow-through--using webbing
d. Tying on with overhand follow-through--around partner's wrist
e. Bowline around self--using rope
f. Bowline around an object--using rope

6. Evaluation: Each student needs to show the instructor that he knows how to tie the appropriate knot. The instructor should then record the student's performance. This is one time when the students do not record their own performance.

7. Helpful hints: Each student always ties his own knots. This concept might be time-consuming, but is necessary. Students who progress rapidly may help other students or learn more advanced "optional" knots such as the figure "8" follow-through, figure "8" loop and the clove hitch. Knots that are tied together "end for end" (overhand follow-through) are generally easier to teach using two different colored pieces of webbing. All support systems should be tied with the knots close to the object. The knot is always the weakest part of the system. For example, the bowline will retain 65% of the rope strength and the overhand loop will retain only 49% of the original rope strength.



Students in a knot tying session. Students are responsible for tying their own knot. And all knots should be visible.

Session VI--Support Systems and Belaying

The students now need to learn how to protect themselves by using one of the support systems, which will be dictated by the amount of equipment which is available and the ability of the class. The system can be as simple as the bowline, which requires no carabiners or webbing, or as complex as the swami belt-diaper, which requires two pieces of webbing and locking carabiner.

The bowline (figure 14), which has already been discussed, works well with beginners if they are not required to take off the rope. That is, at the completion of the climb they should rappel/climb directly down or drop the rope and walk down another easy route. The advantage is the simplicity of the equipment, but its disadvantage is the inflexibility of the class procedures.

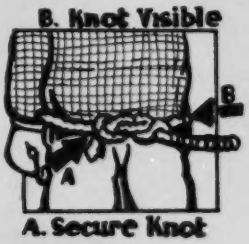


Figure 14: The bowline system, which is the simplest support system.

The swami belt (figure 15) system works well, but it too has disadvantages. The swami belt is composed of two or three wraps of webbing around the hips (not the belly) and tied with an overhand follow-through and secure knots. The knots should be close to the body; this is accomplished by leaving the knot loose and forcing one side of the webbing into the knot and working it through the knot and out the other end. This will require some practice. This knot provides an easy place to secure the rope with an overhand follow-through "tie-on", which is pictured in figure 15 or a simple overhand loop and carabiner for quickly changing ropes/anchors. The disadvantage of the swami belt, as well as the bowline, is that when a fall does occur, the climber usually has the "wind" knocked out of him and he experiences some discomfort. Nevertheless, this system is widely used and is adequate.

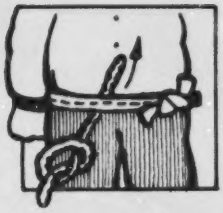


Figure 15: Swami belt system, which is economical but uncomfortable when falls occur.

The leg loop (figure 16) system offers several advantages. First, since it supports the entire hip girdle which is the largest bone mass of the body, it supplies the maximum support. Next, it is an integral system which can quickly be changed from belay to rappel to belay positions quickly. Its major disadvantages are that it takes a long time to fit the webbing to the person properly and once the leg loops are tied (with overhand loops), they are difficult to untie.

The knot is tied by taking about a 26-foot section of webbing and tying two loops just large enough for the thighs, then bringing the extra webbing up in front of the body, wrapping it around the waist and tying an overhand follow-through "tie-on" or an overhand loop and locking carabiner. This is almost a harness system, which is safe and functional.

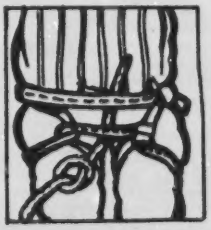
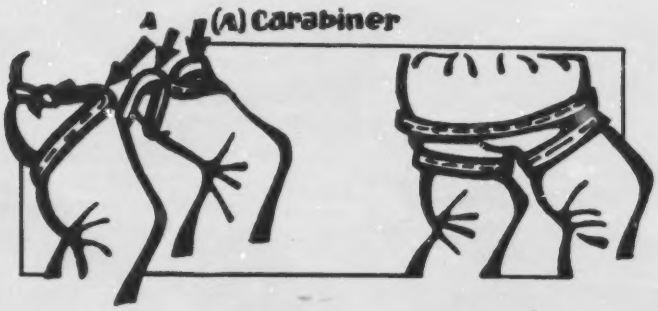


Figure 16: The leg loop system, which is complicated but comfortable.

A system which has been found to be very functional is the combination system (figure 17) which incorporates both the swami belt and the diaper. This system is very simple to put on and offers easy attachment for anchors/ropes; however, the system requires two pieces of webbing (about 13' each) and a locking carabiner. The swami belt has already been described.

The diaper is normally used for rappelling and involves "sitting" into a doubled-over strand of webbing, adjusting, and tying the knot so as to make the diaper comfortable and supportive. The easiest method of determining where the knot should be tied is to "squat" between the two strands, reach down between the legs and grab the bottom piece of webbing with the right hand. Retain a grasp on the two loose ends and keep them even with the left hand--some "wiggling" will help to move the webbing into the correct position. Pull the two loose ends toward the crotch--the position where the knot should be placed is where all the webbing comes together. Mark this spot with your left thumb and forefinger and release the webbing with the right hand, tie a loose overhand knot, and a follow-through with the other end. The reason for keeping the webbing ends at equal length is to help in determining how far through the webbing should go before the knot is tightened and secured. Normally this knot is not tied while being held onto the climber.



The combination system (figure 17) includes both a swami belt and a diaper which are attached with a locking carabiner. This provides for maximum support if a fall should occur, because the entire hip girdle is cradled. Also, anchors are easily attached for belaying and, foremost in importance, is the ease in which students can change from climbing activities to rappelling activities. This is important because students should be discouraged from tying knots and changing equipment at the summit of any dangerous area. Remember, each student should be either on belay or anchored by a "back-up" system, never unprotected.

Figure 17: The combination system, which is simple, safe and comfortable.

1. Objectives and rational: Instruct the student to place one of the safety systems upon himself. This provides a means of attachment to prevent falls while not climbing and a form of protection when a fall occurs while climbing. Also, teach the student the essentials of belaying. Belaying is the technique used in rock climbing/mountaineering whereby one member protects another member from a serious fall by using an attached rope system.

There are four basic types of harnesses that might be used. The simplest is the bowline and the most comfortable are the leg loop and combination systems. The instructor might wish to teach only one simple method, two, or all four.

2. Area: An area that will allow students to converse and move about is required. An outdoor area will work fine, although an indoor area should be available in case of inclement weather.

3. Equipment: Webbing and ropes are necessary.

4. Conditioning exercises: Use the same exercises as previous day.

5. Sequence: Each student should be instructed to place one of the systems upon his body. Then each rope end should be tied (using the overhand follow-through knot or an overhand loop and carabiner) to one of the students. This now places students into climbing partners. With an overhand loop in the rope, one student (the belayer) can now be protected and and he, in turn, can protect his partner (the climber) using the body belay technique. Using a mock (level) climbing area and an improvised anchor, students are now ready to practice the belay technique. The apparatus should resemble the following illustration.

Several important concepts for belaying:

a. The anchor to the belayer should not have any slack.
b. The rope from the belayer to the climber should be just loose enough to allow the climber to move.
c. The safety harness, regardless of which type is used, should fit tightly so the climber can freely move without having the system fall off.
d. It is very important that the belayer's "brake-hand", which is the hand farthest from the climber, never leaves the rope.
e. The climbing rope is kept close to the pelvis girdle of the belayer.
f. The rope is seldom used as a means of assistance. Its intent is that of a backup safety system.

In the above example, the belayer does not relinquish his control of the rope with his right hand. As the climber moves away, the belayer simply allows the rope to slip, controllably, through his hand. If the climber is moving toward the belayer, then the belayer will have to place the rope into his left hand, slide his right hand back, pull the slack forward, placing the slack in his left hand and repeat this process until the climber is secured. In any event, if a climber falls, the rope is tightly wrapped about the hips in a clutching-brake motion to arrest the climber's fall. The following drawings illustrate these three techniques.

(a) Climber Moving away from Belayer

(b) Brake Hand allows rope to slide with control

Brake Hand (A) pulls slack rope into Left Hand (B)

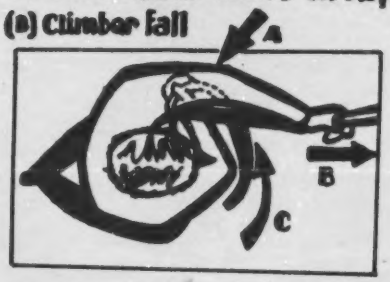
(C) Climber moving toward Belayer

Guide Hand (B) Holds Both Ropes

Brake Hand (A) slides back but Still Maintains Control

(A) Brake Hand Locks on Rope

(B) Climber Fall



(C) Rope is wrapped around Hips

6. Evaluation: After being checked by the instructor, students can record their support system success on the check sheet. (See Appendix, page 98.) Instructors need to observe their classes' belaying technique and critique any error.

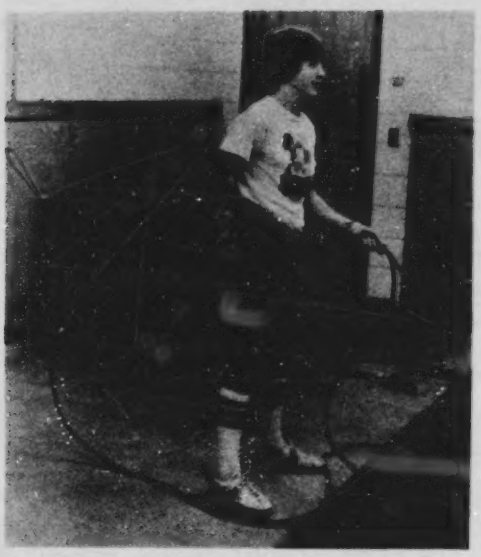
7. Hints: The belaying technique is difficult for some students to learn; its importance might require more instructor time and effort. Most beginners will remove their brake hand while "taking-up" a belay; they will find it easier to learn if they watch their hands. If difficulty persists, holding the backs of their hands, a' la golf, will soon teach them the proper cadence.

Once this belay method has been learned, a figure "8" or stitch belay apparatus may be used; however, all students need to know how to use the traditional belay. The advantage of the figure "8" or stitch mechanism is that the load of the climber's fall is not as shocking to the belayer and a belayer can protect a heavier climber. Obviously with the traditional system, a belayer can be substantially squeezed. The figure "8" descender is more often used for rappelling in place of the brake-bar mechanism and is normally used with Kernmantle type rope, not Gold-Line.

Because the figure "8" descender or stitch machanisms (figure 18) react to a fall spontaneously, they are excellent to use with students possessing slower reaction time, lightweight belayers, or students who cannot seem to learn the traditional belay. It is important, however, that every effort should be made to teach the traditional system because of its simplicity and non-dependence upon mechanical devices.

Figure 18: Using the figure "8" descender and the stitch belay mechanisms for belaying. They are connected directly to the swami belt.

Student practice belaying using the level "mock" technique.



To insure that the belay stays near the hips, a carabiner may be used to maintain the rope near the support harness.

Session VII--Climbing Signals

1. Objectives and rationale: Instruction of climbing signals must be introduced. Communication is a very important aspect of safe climbing. The belayer needs to know what the climber's actions are at all times, even when he is not in sight. This is normally done by voice commands, which are often difficult on windy ledges. Rope signals are never used and are surely of Hollywood origin. There is a universal language that climbers use, although there may be some slight variations. Normally, the climber commands and the belayer reacts physically. The belayer responds orally also to assure the climber that the necessary modifications have been enacted. The sequential calls on a typical climb are:

"Is belay on"---this is the first call given by the climber. He does not proceed until he receives an affirmative answer from the belayer.
"On belay" or "belay is on"---this is the belayer's reply that he is ready for climbing to begin.
"Climbing"---the climber is indicating that he is ready to take his first step. He does not start, however, until the belayer responds.
"Climb"---this is the belayer's response that he is ready for the climber to begin climbing. It is at this point that the belayer assumes climber responsibility.
"Off belay"---when the climber reaches his destination, ties his overhand loop (or clove hitch), and anchors, he makes this command to

indicate that he no longer needs a belay.
"Belay is off"---is the belayer's response. The climber's responsibility is now his own. The belayer is free to remove the belay. The end of a successful climb.

Other signals that will need to be learned are:

"Testing"---used by a climber if he wishes to test a belay system. This might be necessary if it appears that the rope might have too much drag or a questionable anchor.
"Test"---the belayer's response. He generally releases a small amount of rope and waits for the test "tug."
"Up rope"---if there is too much slack, the climber will make this command, whereby the belayer pulls the rope.
"That's me", "O.K.", or "thank you"--the climber announces enough slack has been retrieved. Care needs to be taken by the belayer so he does not pull the climber off his support during the slack retrieval.
"Slack"---if the climber needs some rope for a tricky move/traverse he would make this command. The belayer only releases a small amount of rope at one time. When the climber is again ready to climb, he should announce--"climbing."
"Tension"---is used by the climber to direct the belayer to pull the rope with all his strength. This is for rest stops, tricky moves, or to develop climber confidence. This call is rarely used.
"Falling"---the call used by the climber if a fall is imminent. The belayer should "set" the belay immediately! Once a fall occurs, the belayer will have to listen intently for further directions because the climber will have to swing, pull up, or be lowered to some form of support.
"Rope"---is used anytime a rope is thrown to warn anyone below. This is normally used in setting up a belay/rappel.

2. Area: Secure an area where as many belay systems can be constructed as ropes are available. An outdoor wooded area works well since trees can act as anchors.

3. Equipment: Ropes, webbing and oval carabiners are required.

4. Conditioning exercises: Same sequence or some other equally invigorating exercises for variety can be introduced.

5. Sequence: The class should be arranged to provide for conducive student signal learning; after they have learned all the signals and movements, then the alternative devices (figure "8" and stitch) may be used. Once the movements and signals are well established, blindfolding belayers and adding mock falls teaches necessary belayer alertness.

6. Evaluation: Students evaluate their partners and check them accordingly on the check sheet. Chances are they will be partners when the actual climbing begins; therefore, they usually critique each other well in their quest for safety.

7. Hints: "Slack" and "rope" commands are frequently confusing. The instructor might use "take up rope" and "give slack" to help students better understand the meanings. Once the signals and belay techniques are learned, the students are ready to climb, but nobody should proceed to

climb until belaying and signals are habitual.

Session VIII--Preparing for the Climbing Trip

1. Objectives and rationale: Before actually engaging in a climbing venture, students need to know the different types of climbs and how climbs are rated. As previously stated, students need not be told where to place each hand and foot, but only what options are available. Also, when beginners read climbing routes, they should know the meaning of the terms. There are nine standard types of climbs. These are described below:

a. Face climbing is the classic form of climbing that incorporates a ladder climbing movement. Essential to this style of climbing is keeping the weight on the feet. Students should use the three-point rule (pages 4-5) and the inside (strongest) portion of the feet whenever possible. Holds with the hands include climb holds such as hand-holds and finger-holds. Foot-holds, toe-holds and pressure-holds are also used with the feet.
b. Jam climbs involves expanding a part of the body (finger, hand, foot, arm, leg or body) inside a crack, crevice or fissure.
c. Chimney climbing is descriptive of the technique of stemming the body upward as though it were inside a smoke stack.
d. Lay-back climbing involves grasping a vertical crack and pulling, while the feet push. The climber simply lays-back and ascends the vertical crack.
e. Bridging or open-book climbing requires applying pressure outward while climbing up a corner. Similar to chimney climbing but more difficult to obtain equal opposition forces.
f. Slab Climbing is similar to friction climbing except the angle is extreme enough to require the use of the hands.
g. Friction climbing has already been discussed.
h. Mantling is a method of ascending onto a small ledge (mantle) by placing the finger-tips of both hands toward one another and stemming upward until one leg can be placed on the mantle. The next leg follows, completing the movement.
i. Undergrip climbing is one of the more neglected forms of climbing. Often the most advantageous hold is from below, initiating an upward force with the hands and a downward force with the feet which results in a supportive counterforce position.

Obviously most climbs incorporate many of these techniques. The more techniques a climber is aware of, the easier and more efficient the climbing procedure.

2. Area: It would be most advantageous for the instructor to take the class to an area where most of these movements could be demonstrated. Since this is not usually possible, slides with examples of each would be helpful.

3. Equipment: The necessary components to graphically describe the above-mentioned climbs will be required.

4. Exercises: Inasmuch as this will be primarily a discussion period in preparation for the advancing climb, exercises should be vigorous and

organic.

5. Teaching sequence: Introduce the climbing techniques as described above and organize the next session's climb. The instructor should be well acquainted with the "tripping" procedures. Students are responsible for equipment maintenance. Each student should have a task.

One of the many questions that arise is: "How are climbs rated?" This is an important question for beginners since they need to be sure they do not attempt climbs beyond their abilities. Without this knowledge, they might unknowingly jeopardize their safety. These rates should not be confused with mountain climbing difficulty rates; only rock climbing difficulty will be considered within this text. For the most part, the Sierra Club has established route classifications to be used in the United States. These ratings are not universal; the Europeans have their own system. The Sierra system is a rating for the average climber's rate:

RATING:

1. Walking with specialized shoes such as hiking boots
2. Scrambling, sometimes using hands
3. Easy climbing with some exposure, rope sometimes worn
4. Moderate climbing, exposed and belay essential
5. Difficult climbing, very exposed; piton/anchors normally used to protect the leader
6. Extreme difficulty; equipment is used for direct aid
7. Impossible, perhaps supernatural aid required

Most of the class work will include climbing one through five class difficulty with a focus on predominately class five and the use of top belay or the top-roping technique.

The class five is also subdivided into "10ths" with 5.1 being easier than 5.2. The climbing class should not progress beyond 5.5 or 5.7, depending on their ability. After some experience, it's fun to rate and name climbs; usually the first ascending climber has the honor of rating and naming "his" climb. Normally this requires a "lead" climber; however, the method recommended here eliminates the "lead" climber. For class enthusiasm, the first climber should have the option of name and rate.

6. Evaluation: There is no evaluation at this time. Remind students to be responsible for the information in order to be prepared adequately for the imminent climb and written examination.

7. Helpful hints: Any form of visual aids will help students to understand climbing techniques. A cement block works well to demonstrate most of these concepts, especially jams.

Session IX--Climbing Trip

1. Objective and rationale: The students now should be well-primed and conditioned mentally and physically for a climb. They will be most anxious to begin with the more realistic aspects of climbing. Preparations should be made (refer to the outing procedures) to actively climb "on the rocks" for at least one and a half hours, longer if time permits.

2. Area: Any area close enough to permit safe climbing will be sufficient.

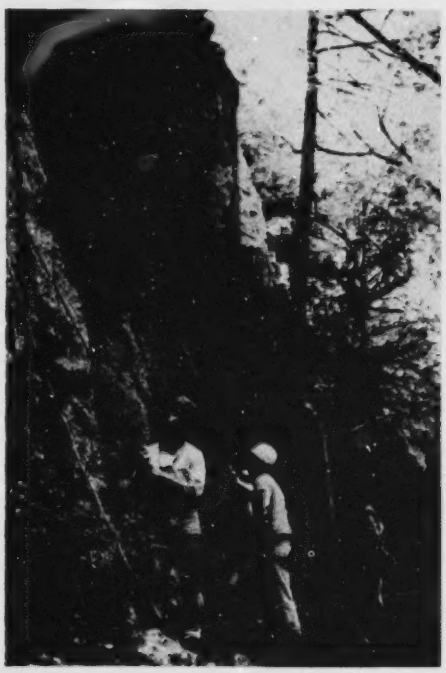
3. Equipment: All the climbing, safety and first aid equipment should be transported by the students.

4. Exercise: None will be necessary since the climbing will fulfill this requirement.

5. Sequence: All the procedures as stated in the outing and safety procedures should be followed. Students need to be reminded to wear loose clothing, not to wear any form of jewelry, and possibly bring rain equipment. If possible, the climbs should be close enough together to offer adequate instructor supervision. The climbs could be roped (before the class arrives) and offer as many of the different varieties of climbs as possible.

Each student should have the opportunity to climb and belay. Also, each climber should "kick his feet" on the base of the wall to remove any soil/mud from his boots; this enables the next climber to ascend more easily. The "summit" of the climb should be accessible to permit the climbers to walk down. An instructor should be placed at the "summit" to supervise belayer's and climber's position changes and to return the belay rope to the base of the wall for the next climber.

One or two stations should be designated by the instructor as a "down climb." This teaches the students to watch their feet, which is very important. Down climbing is also safer than rappelling; however, the process is time-consuming.



A climbing class on an outing climbing up and down. Note the boy in the foreground testing the rope to make sure the rope will slide through the carabiners without difficulty.

6. Evaluation: Students should be encouraged to attempt as many climbs as possible. Upon climbing and belaying each climb, they should check their score sheet.

7. Hints: The top rope system (figure 19) is a "pulley-type" of affair to protect the climbers. Basically it involves some webbing, a good anchor and locking carabiner (or two oval carabiners with opposing gates). The webbing should be long enough to allow the carabiner to hang over the edge. This will prevent the rope from rubbing excessively on the edge of the summit.

Figure 19: A top rope system anchored to a tree. Note that the rope will not "rub" on the edge.

The belayer at the bottom (figure 20) should be well anchored and instructed to keep the rope relatively tight. Because the rope will be running up from the belayer, he should place an oval carabiner on his swami belt and allow the rope to "run" through it, lest he lose control of the rope if a fall should occur. If one of the mechanical belay devices are used, this problem will not occur.

Figure 20: Belayer anchored to a tree. The belay is "run" through a carabiner to prevent the rope from working up the belayer's body if a fall occurred.

For the top belay, the belayer needs to be well anchored on top with the same relative instructions as in figure 20. The anchor should not possess any slack.

The instructor should use every means to prevent any time waste. This is one of the culminating activities, and requires the utmost planning and efficiency. The students will be anxious for actions and their enthusiasm will be high; therefore, the instructor needs to be totally prepared. To save time while climbing, an overhand loop with a locking carabiner at the ends of the ropes will facilitate changing of the climbers and belayers.

Session X--Rappelling Basics

1. Objectives and rationale: This session introduces another method of descent--rappel. Rappelling is one of the more "fun" parts of the strenuous sport of rock climbing. Rappelling also can be dangerous for several reasons. First, because it is enjoyable, many climbers will forget to affix or fasten some form of the apparatus properly. Second, descents are normally made after a climb, when the day is drawing to a close. The climber is tired, and he is hurrying to affix his equipment. Third, some climbers make the mistake of using the rappel without a belay back-up system. This is dangerous because the climber then relies 100% upon his equipment; any error in judgement or faulty equipment can result in tragic consequences. Under no circumstances should students be allowed to rappel without a belay.

Although there are many methods of rappelling, this section will deal only with the leg-loop and the swami belt or bowline. If the leg-loop or combination system is used, a diaper (Swiss seat) will not have to be constructed for each student; this is another advantage of the leg-loop or combination system. If a swami belt or a bowline is used for belaying, a diaper or a figure "8" will have to be constructed.

A figure "8" loop (figure 21) is simply a loop made of webbing large enough for the legs to pass through after the loop has been twisted into an "8."

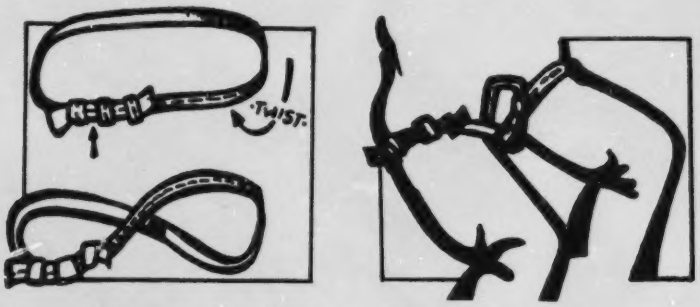


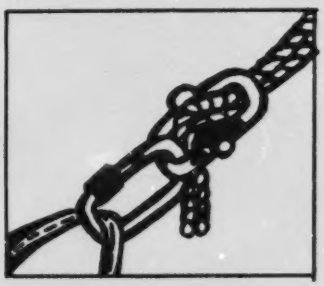
Figure 21: Making a figure "8" loop.

The overhand follow-through knot is used to tie and adjust the two ends. One disadvantage to this method is that the harness tends to "fall down" when the climber attempts to walk.

The diaper, which has been described with the combination climbing system, can be used for rappelling with the bowline or the swami belt. If a bowline or swami belt is used for climbing, then an inexpensive technique for rappelling would be the figure "8" loop because it can be easily shared.

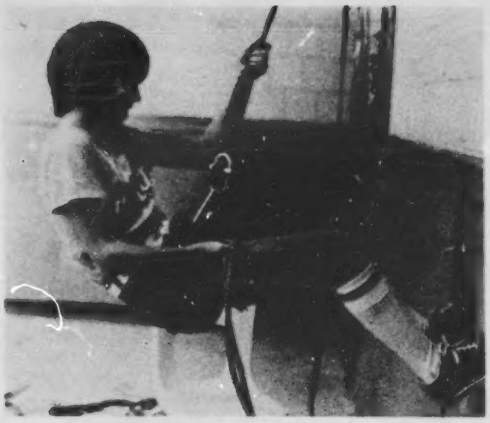
Regardless of what harness system is utilized—the figure "8", the diaper, leg-loop system, or the combination system—a locking "D" carabiner is attached. Then a descending unit such as a brake bar, double carabiner, or a figure "8" descender is attached to the locking "D."

If a brake bar system is used, it's imperative that the rope is on the correct side of the brake bar! If not, the rope's pressure will release the brake bar and offer no resistance for the descent. This is another reason for the belay back-up system. Basically, the simplified system with the rope correctly placed, should look like this:



If the carabiner brake is selected, it should resemble the following system which uses oval carabiners with opposing gates (opening in opposite directions); however, the rope should never "run" on a gate. Obviously this system requires many expensive carabiners.

A student practicing the "walk-rappel" which allows the student to practice several rappelling techniques safely. Notice there is no belay for this practice.



A student practicing the static hang in the rappel position as a means of checking for braking ability.

The safest, but most expensive, descending unit is the figure "8" descender. This unit has no gate to worry about and will descend beginners slowly. It works best with Kernmantle-type rope, but also will function well with Gold-Line. The figure "8" descender is especially functional with very heavy or apprehensive students. To attach the device to the rope, the descender is released from the carabiner; the rope is then hooked and pulled through the large hole and looped over the end; the descender is then reattached to the carabiner. A properly attached unit should resemble the following diagram:

With any harness system, any "left-over" webbing on either side of the knot should be secured. Remember, this is not to provide additional security but to prevent the loose ends from entering and jamming the mechanism.

Signals are essential for rappelling also, but "on rappel" and "off rappel" are used in place of "climbing" and "off belay." After going "off rappel," the rappeller should remove himself from the area so he will not be struck by any falling rocks that might be dislodged by the next rappeller.

The concept of rappelling involves controlling this descent by "braking" with one hand. The top hand simply keeps the climber close to the rope; most beginners will hold too tightly with the top hand. The bottom hand controls the rate of descent. The rope may be held at the side (figure 24), while the descent is controlled by pulling the rope closer to the body and gripping the rope more firmly. The hand should remain clear of the break-bar mechanism lest the fingers be drawn inside. Another method is placing the rope under the seat and "sitting" on the rope while rappelling (figure 25). This descent is controlled by the hand on the opposite side (still the bottom hand); this might require changing the hands around. Heavier people should use the latter technique since more weight can be supported and controlled easily. Beginners will also like this method better.

Figure 24: The rope to the side rappel.

Figure 25: The "sit on rope" rappel.

The ropes are anchored similarly to the belay top rope method, except they should be placed high; the anchored rope should never be placed below the edge. The rationale for placing the rope high for the first rappel is to provide ease for the rappeller when leaving the edge. In this position he only needs to "sit down" over the edge and "tip-toe" down the face.

If the rope is low, the rappeller has two choices: either leave the edge on hands and knees while easing himself over the edge or leap backwards (controlled) from the edge (figure 26). Although students should not attempt to leap backwards during their first low rope rappel, they should attempt rappelling using both techniques.

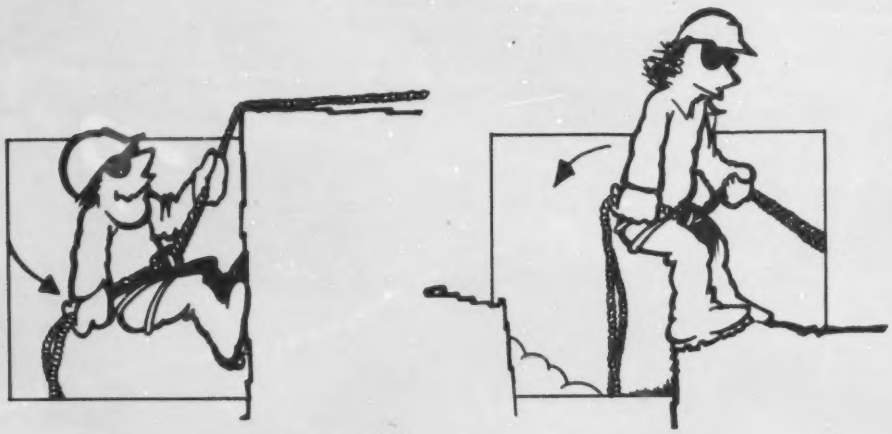


Figure 26: The "leap" rappel using a low anchor which is to be attempted with caution.

There are two things to remember when rappelling. One is to keep the legs well spread in the "sitting" position. This will prevent the body from pirouetting and "slamming" into the wall. The other is to remember that equipment will become hot while descending, therefore caution needs to be conveyed by the instructor. Some people use gloves to rappel; this should be discouraged because gloves only enhance speed. After proficiency is learned, gloves may be optional.

All rappellers should be on one rope doubled or two ropes tied together with the knot at the apex for all class work. The double rope will provide adequate friction for the descent. If one doubled rope is used, it should be tied with an overhand loop in the middle and attached to the anchor by a locking carabiner; a mark (with a felt marking pen) halfway on the rope will expedite this matter. This will insure the student's safety if he should attach to only one rope. Both ends of the rappel ropes should be long enough to reach the base; an insurance measure to prevent the students rappelling off the end of the rope is to tie on overhand knot on the ends. Also, in tossing a rope, the climber should yell "rope" to alert others. A top belay or top rope belay is always used.

2. Area: An indoor or outdoor level area that will provide "anchors", such as trees, is necessary.
3. Equipment. All ropes, webbing and carabiners will be required.
4. Conditioning: This is the instructor's option.

5. Sequence: The students need to learn one of the harness systems unless the leg loop or combination method has been taught earlier.

The concepts as specified above need to be emphasized with the students. After the harness and concepts are understood, actual rappelling action should begin. The simplest way to teach rappelling is with a "walk rappel." The ropes are anchored low in a level area; without a belay, the students attach their brake system, and walk backwards to the end of the rope. While walking, they are instructed to try various hand placement and braking techniques. This allows several students to use the same rope. Next, belays and signals are added.

6. Evaluation: Each student should be checked by the instructor and his score recorded on the check sheet (page 98).

7. Hints: This session might require two or more days; everyone must understand the rappelling process before an outing can safely proceed. If, during the walk rappel, students place the rope on the wrong side of the brake bar or the ropes are placed "upside down", allow them to proceed. Students will soon see the consequences of their errors. This trauma will make them think out their problem and motivate them to investigate and correct their errors. It's better to have them make and correct errors on this level than for the instructor to do it for them during an outing experience.

Session XI--Rappelling Outing

1. Objectives and rationale: This session will provide an outing for students to experience the rappelling process. The format for this venture should be similar to the climbing outing. It's generally best to isolate these two skills (climbing and rappelling) for the students' introductory outing. This allows them to prepare for one concentrated effort in each area.

2. Area: Use the same area that was used for climbing.

3. Equipment: All first aid safety and climbing equipment will be needed. Students should maintain, count, and pack equipment.

4. Conditioning: The activity will provide the necessary exercise.

5. Sequence: The same anchors that were used to belay in climbing can be utilized in rappelling. All rappels should have belays anchored to other structures if possible (figure 27). The rationale for this is if the rappel-rope anchor fails, the belay anchor has to hold. As many rappels as possible (usually six) should be established, with half (three) utilized in the easy "high" position. It would be advantageous for the instructor to station himself at the summit and visually survey the rappelling process to insure proper equipment manipulation at the onset of the activity. Once a student has succeeded with the high anchor rappel, he should proceed to the crawl (hands and knees) rappel and finally to the leap rappel. All the safety concepts/rules should be closely followed. Belays and helmets are always required.

6. Evaluation: Students should be "checked" by the instructor relative to their high and low rappel. Time will probably permit them to have many opportunities to rappel down the rope; this should not be discouraged since the students will develop proficiency, skill, and

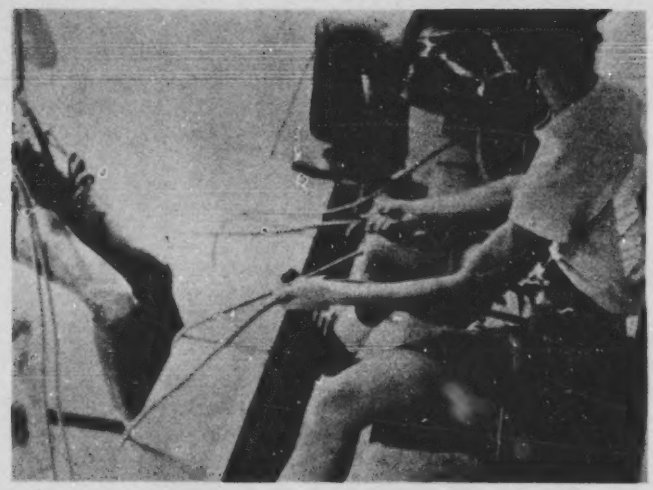
knowledge through practice.

Figure 27: Rappelling with a back-up top belay for safety.

7. Hints: Again, if the students do not attach themselves properly to the descent mechanism, they should be allowed to continue as long as they have a reliable belay and a high rappel anchor. The trauma of a "popped" brake bar or a tangled "upside down" rope will vastly improve their care on succeeding trips. Before attempting any "leap" rappels, they should be stopped and alerted to the faulty nature of their equipment lest they become injured. All students should attach all their own gear and rely on themselves. Since time is valuable, the instructor should attempt to have as much equipment prepared in advance as possible. Students should be encouraged to tuck in all clothing to avoid its jamming in the brake bar.

Rappelling can be taught well in a gymnasium by using the bleachers as platforms. Anchors will have to be carefully installed/checked if a gymnasium is used.

The bleachers can be used as a means of checking-out students' rappelling ability. Notice all students are belayed and have helmets on. All safety concepts need to become habitual.



The above picture shows the proper belaying position when practiced on the bleachers. All rappels should be belayed in such a manner. The feet are well braced and the student is anchored to the bleacher-wall bracket.

Session XII--Student Conducted Trip

1. Objectives and rationale: Students are provided with a session on their own in which they manipulate all the equipment, set all the anchors, and decide where climbs will be conducted. Often, a small amount of knowledge is dangerous. The instructor should assume that whatever he teaches the students will be valuable enough for them to utilize or practice outside the class setting. Many of the students will want to do some climbing, therefore they need some practice in setting equipment. Top roping and the "walk up-top belay" are the only two methods that were taught and should be practiced. Teaching lead-climbing is another subject but will not be discussed here.

2. Area: The area used as the outing for rappelling and climbing or an adjacent area can be utilized for this activity.

3. Equipment: All the climbing, safety, and first aid equipment will be needed.

4. Conditioning: One day for planning and psychological conditioning might be necessary. This task cannot be hurried.

5. Teaching sequence: Students should be in charge from the time they leave the bus. The teacher should only interfere when a student error might perpetuate an accident. They should be instructed to establish four climbs and two rappels. All rigging should be carefully checked and thoroughly critiqued by the instructor before the equipment is used.

6. Evaluation: On the succeeding day, the student should critique himself, noting good and poor practices, and give himself a grade. This is both interesting and revealing. Most students are amazingly objective.

7. Hints: This is an opportunity for the instructor to "sit down" and evaluate the class from a distance. Leaders will evolve from the situation and "take command." This is not only interesting, but also good to note for future projects. This will probably prove to be one of the class's favorite ventures simply because most of the responsibility has been passed to them and they feel they have to prove they can handle it.

Session XIII--Course Evaluation

1. Objectives and rationale: The last day of the course should be reserved for introspection, recommendations, cautions, and a final examination.

2. Area: If weather permits, this can be accomplished outdoors.

3. Equipment: Pencils, final tests and check sheets will be needed.

4. Exercises: No exercise will be required.

5. Sequence: The written test needs to be administered first, followed by a discussion of the values of the course, of any criticisms, and of ideas to improve it for the next year.

6. Evaluation: The written test should emphasize concepts rather than memorization, with rules of climbing being the only exception. See Appendix, pages 102-104 (test enclosed).

7. Hints: It's important that the instructor does not react defensively to criticism. He should carefully analyze the suggestions in the hopes of improving succeeding classes. The written examination should also be regarded as a "teacher evaluation" in which student retention will be proportional to the thoroughness and importance of the instruction.

OUTING PROCEDURES

The ideal situation would permit the instructor to gather his class, trek to the climbing area and, without the pressure of time, conduct the outing adventure. Generally, this is not the case; preparations for the outing and the "tripping process" need to be highly organized. Sometimes the administrative aspects of trip logistics can require as much emotional energy as the teaching process. This portion of the text is designed to reduce some of the confusion involved with the outing preparations.

The climbing area chosen should be as close to the institution as possible to prevent excessive travel time. Once an area has been chosen, it should be visited and pre-climbed by the instructors. Students should not be expected to attempt climbs that instructors have not climbed previously. This is also true for the rappelling format. As mentioned, permission to climb in an area needs to be received from the owner or a representing official in the case of public ownership.

Once the owner grants permission, the climbing instructor needs to obtain permission from an administrator or the department chairperson, from other instructors (if the trip will require absences from other classes) and the students' parents (if the students are minors). With these acknowledgements, the outing should progress smoothly. The administrator should be aware of what is occurring in the class and he might be surprisingly impressed; he may also be the individual to contact for providing transportation. If the selected time of the outing adventure necessitates student absences from other classes, the affected teachers should be alerted before the trip. Every instructor, or so it seems, feels that he/she is teaching the most important subject; and perhaps they should express this attitude. Therefore, the climbing instructor needs to recognize and honor this attitude by notifying other teachers of imminent absences. The climbing instructor might need to reciprocate the favor at some later date in an effort to maintain cooperation among the staff. Also, it's most important that parents are aware of students' activities in class. If students are not considered adults, they should be required to bring a signed permission form (see page 97) from their parents which should include where and when the students will be trekking and in which activities they will be engaged, as well as where and when the instructor can be reached for consultation. This generally has a positive affect toward teacher-parent relations.

The instructor needs to understand anchor functions and how they are placed. Again, artificial anchors such as pitons, chocks and nuts will not be the focus here. Generally, all introductory climbing can proceed without these expensive and time-consuming artificial anchors. Trees and boulders are more secure and provide for easier anchor installment. One method of anchor installment is simply to drape a piece of webbing (the swami belt length) around the tree or boulder and tie the ends together with an overhand follow-through and secure knots. Then attach the rope with a locking carabiner.

Another method of setting anchors is to use "loops" or "runners." These are short pieces of webbing, about six feet in length, that have had their ends tied together with an overhand follow-through knot jammed tightly. These loops are generally carried over the neck/shoulder by the instructor and can be quickly attached to a tree by looping it through itself (figure 28) and attaching the rope with a locking carabiner.

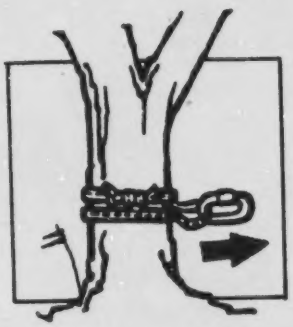


Figure 28: Using a tree, "loops" or "runners", and a locking carabiner to form an anchor.

Familiarity with the busing process is essential to properly implement any type of outing. First, there should be knowledge of the budget and if there is enough money for the trip. How far in advance does the bus have to be requisitioned? What will actually be the outing date? If students are of post-high school age, many of these administrative duties may be deleted; the students simply meet the instructor at the designated area or follow the instructor's vehicle to the climbing vicinity or car pool the trip. Regardless of the mode of transportation, the instructor should have an adequate knowledge of the institution's travel policy and insurance requirements.

Another instructor, on location, would be most helpful. This would expedite matters should an accident occur. Also, one instructor at the base of the climbing area and the other at its summit will enhance climbing activities. It would be helpful, but not essential, for both to have some climbing experience. The instructor might consider "giving the course" to a faculty member who would be willing to fulfill this obligation. This offers an opportunity for members of the academic disciplines to participate and experience the benefits of outdoor adventure. This also provides an ideal opportunity for faculty members to take some outstanding photographs that could enhance the activity.

With a scheduled climbing outing, or any other outdoor activity, an alternate activity should be prepared. The weather can always change and "forcing" an outing through bad weather can discourage any furthur outdoor adventures. Movies are one of the better activities since they can be shown in a confined area and offer climbing appeal. Movies, however, can rarely be retained on a rental basis for more than three days; therefore, one good purchased film can be saved for this purpose.

The class session preceding the climbing/rappelling trip should include a thorough student briefing. Not only should rules and concepts be re-emphasized, but also equipment responsibilities need to be delegated. A student needs to be assigned the duty of supervising the equipment pack, another for the first aid kit, another to transport the helmets, and several students to carry the ropes. The first aid kit is an easy item to forget; this is an essential piece of equipment and should automatically accompany any field trip which leaves the school campus. The trip might also require food, certainly water; therefore, a pack should be prepared accordingly.

The instructor will also need to prepare for proper sanitation of the area, should he or one of the students need to urinate/defecate. An area should be selected at some distance from the climbing area and off the trail. An accompanying shovel to dig the necessary 8-inch hole and some white toilet paper should remain at the site. Before leaving, the used paper should be burned, provided there is no fire danger, and the hole filled. The students need to have a basic knowledge of environmental etiquette to fully understand and respect the natural surroundings.

The importance of an emergency evacuation should be re-emphasized. That is, if an injury does occur, what are the procedures? Is there a citizen-band radio aboard the bus? Where is the nearest phone? Does the instructor possess enough basic first aid training to attend most injuries? Without being overly pessimistic, always expect the worst and be particularly thankful when nothing serious occurs; caution and preparation will eliminate most accidents.

Every outing should include a student and teacher evaluation as soon as possible after the trip while the experience can be remembered. It's important that the observations and feelings are recorded before the critical issues are forgotten.

ARTIFICIAL CLIMBING WALLS

A development that has greatly enhanced the sport of rock climbing in schools has been the manufacture of artificial climbing walls. However, artificial climbing walls are not a recent innovation. The William G. Long Camp outside Seattle holds the distinction of being the first institution to build an artificial climbing facility, in 1941, known as the Schurmann Rock. The French developed adjustable wooden climbing walls during the 1950's, but the British, in the 1960's developed most of the climbing facilities, with well-known walls at Glenmore Lodge, Penrith, and Cumberland. Adjustable walls were marketed in 1963; presently there are four manufacturers of climbing walls in Britain. However, many of the British walls are built outdoors at very accessible heights, which are invitations to disaster. Also, many of the walls were built by removing mortar and bricks, a practice that would seem to be disfiguring and permanent. However, with the consent of the architect and building engineer, this would be an economical option.

Walls have many advantages, although certain precautions and rules should prevail. This chapter will emphasize these precautions and rules as well as instruction on how to build a wall, what materials to use, and how to conduct classes using artifical climbing walls. First, however, the advantages.

The many advantages of climbing walls fit well into the limited budget of a public school system and, once built, can be of service for many years. Other advantages include:

1. A relatively small and seldom used room can be utilized. This provides more flexibility in programing as well as increasing the spectrum of the curriculum.
2. Provided the room can be locked, climbing equipment can remain intact and ready for use. Therefore, more climbing time is provided and less equipment maintenance is required.
3. There is no cost of transportation in terms of money and/or time. One of the problems with any outing is that it often interferes with other programs/classes; the climbing wall enables a rock climbing unit to function well within the traditional scheduling system. The cost of building a climbing wall can be justified rationally by the transportation savings alone.
4. A variety of climbs can be designed closely to enhance supervision. This is an ideal situation which the outdoor environment seldom provides. For example, good chimney climbs are often difficult to find, but one or two can be simply constructed on the wall adjacent to other climbs, providing optimum learning situations and supervision.
5. The cost of a wall can be inexpensive, provided the instructor is willing to spend some time in its design and construction. One of the functions of this chapter is to aid in climbing wall design and construction, therefore reducing some of the research, design, and construction time. This is not to imply that the instructor should not

seek help from local contractors, building engineers, and architects; they should be contacted for their expertise and guidance.

6. Weather is not a factor when rock climbing indoors. Obviously, this is an important advantage because scheduling is easier and absences from other classes, due to outings, are less frequent. Therefore, the factors of weather instability and differing seasons are eliminated, which provide for a relaxed teaching-learning situation.

Before continuing with the options of building materials for a wall, certain precautions and guidelines need to be emphasized. The instructor needs to be aware of these before proceeding, or a disfunctional, unsightly mess will result on the wall. Listed here are the most important precautions the instructor should consider:

1. The structure should be well planned, on paper, with cost requirements. That is, the cost of steel and wood for platforms, concrete and bolts for the rocks, and anchors should be calculated. Everything that is needed for the wall needs to be itemized, so a realistic cost factor can be presented to the administration. This is very important because the concept of a climbing wall will need to be explained in detail to the administration.

2. The instructor needs to be totally familiar with the wall space that he intends to use. He needs to visit the building engineer and inspect the building plans to determine what's behind the wall and what other activities and structures might be affected. He also needs to visit the architect to determine if the wall space will support a climbing wall. That is, is the ceiling high enough? Is the wall made of cinder blocks or concrete blocks? Does the room have a false ceiling? Is the wall itself false? These are questions only the engineer or achitect can answer. No building should proceed without their written permission.

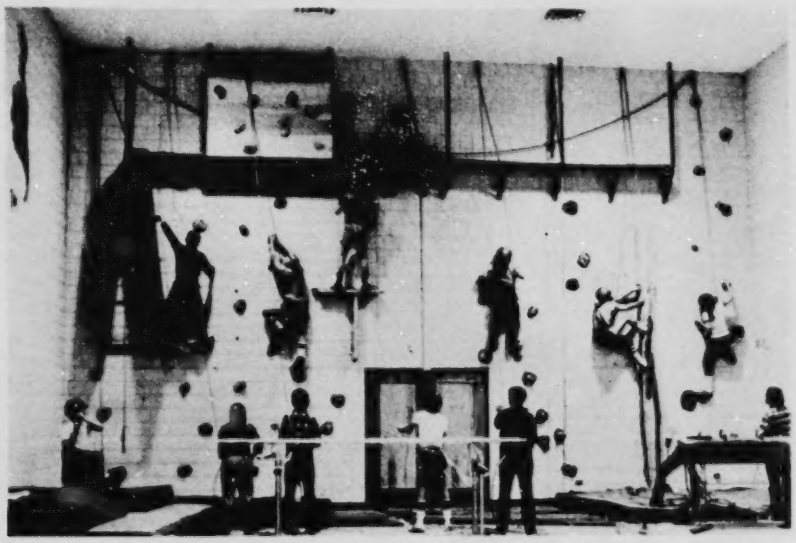
3. When the artificial rocks are ready to be anchored, some of them should be placed in positions which provide creative climbing. That is, the rocks should not be placed ladder-style, which is too obvious and simple. Useless rocks need to be placed at some points to stimulate thought.

4. Every attempt needs to be made to maintain security. The ropes should always be pulled up or stored to eliminate the possibility of unscheduled climbs. Also, the room needs to be locked or the wall made inaccessible.

If the wall is placed in a gymnasium where activities often takes place, the first rocks should be placed high enough to inhibit climbing. When the climbing class is scheduled, the rocks can be reached by using movable plywood sheets with rocks placed on them. Or, the rocks can be covered with a plywood sheet locked in position when climbing is not scheduled.

5. The wall should be planned and constructed so that all stations will be accessible by the instructor in case of an emergency. That is, if a student should become entangled in the ropes or needed assistance with a knot, the instructor should have no difficulty reaching the student.

Here is a typical rock climbing class with all students actively climbing and belaying under the watchful eye of the instructor. Note that all belayers are anchored to gymnastics apparatus, all climbers are helmeted and top-roped. The student at the top of the platform is anchored with a carabiner to the horizontal rope. Stations, from left to right, are chimney climb (next to wall), teacher's emergency ladder, open-book climb, overhang climb, mantle shelf climb, a rappelling station, zig-zag climb, another rappelling station, lay-back or jamb climb and a face climb.



Bleachers can be improvised for a climbing wall. Note the climber practicing the three-point rule (pages 4-5) and the belayer, who is anchored, alertly watching.

A platform connecting all stations works well or a moveable ladder will also work. Nevertheless, the instructor should expect to monitor the students closely.

All walls should include some type of sign indicating the rules. Large block letters on white tag-board covered with plexiglass works well. Among these rules should be:

1. No unsupervised climbing.
2. All climbers must wear helmets.
3. All belays must be anchored.
4. When climbing, you must be belayed/anchored at all times.
5. Snap onto anchor before going off belay.
6. Try to use the three-point rule at all times.
7. All rappels must be belayed.
8. Don't "hot-dog."

Notice that these rules are easy to read and understand. Any student who refuses to follow the rules should be prohibited from entering into further climbing activities. Students generally are so anxious to climb that they seldom are a discipline problem. Sometimes in their excitement, they simply forget the rules and need to be reminded.

Once the instructor is committed to a wall building project, he will need to be totally dedicated to its completion. It will take a long time and a lot of work to complete the project, therefore the instructor should attempt to get as many staff members as possible involved.

There are several avenues that can be taken in the selection of construction materials. This decision should be based on the budget, area to be used, time that can be dedicated to the project, and expertise of the individuals or the persons involved.

The construction of the wall can be made of plywood, particle board, manufactured rocks; or a combination of these. All walls should include some type of platform from which the students can rappel and belay and from which the teacher can monitor these activities. Each type of construction material has certain advantages and disadvantages.

Since plywood is very economical and can be made portable, it could be attached to bleachers, a concrete wall, or any other stable structure. Blocks of hardwood can be bolted to the board for hand and foot supports. Holes can be cut with a saber saw, into the board for similar supports or jambs. Manufactured rocks, which will be discussed later, can also be bolted to the wall. This type of wall can be constructed very quickly and offers a variety of climbs. Marine plywood 3/4 to 1 inch thick works the best. If there is no chance that the structure will get wet, then a lesser grade of plywood could be used.

One of the major disadvantages of a plywood wall is that the wood will "splinter." This can produce painful slivers in the hands and knees. Splintering will also cause the desirable corners and edges to wear "round", therefore reducing the support area. Splintering can be reduced by sanding the surface with a power sander and sealing it with a commercial sealer. If the supports are made of hardwood blocks or manufactured rocks, the sliver problem will also be reduced.

A simple wall constructed of plywood and hardwood blocks. Note the rappelling platform. Students, however, should have helmets on.

Particle board is similar to plywood except that the grain of the wood fibers in particle board is in many directions. This is advantageous because the edges of particle board supports and jambs will retain their sharpness for a longer period of time. Particle board is not as strong as plywood; therefore, the particle board should always be mounted flush against the wall or bleachers. Again, there might be a problem with slivers unless it is sanded and sealed.

The most desirable type of wall is constructed of manufactured rocks and slabs. The advantages they offer are that they are strong, when constructed properly, offer a variety of climbing experiences, are durable, and are realistic. Because of the complex nature of constructing this type of wall, this chapter will discuss, in detail, its planning and construction.

Concrete is the basis for making the rocks and slabs; therefore, some general concepts need to be understood relative to available concretes, the mixing process, the curing time, methods of fastening, and techniques for making molds. Each concept is important in developing a strong, well-designed rock that can easily be attached to the wall. No construction should proceed until the instructor has experimented, to some extent, and has become proficient with handling concrete.

There are several types of concrete that can be used for making rocks and slabs. There is no reason that the instructor should attempt to mix raw sand, gravel, cement, and water into concrete. Pre-measured

concrete, which is sold in small bags, will make the task easier and there will be less of a chance of error. A 90-pound sack of packaged concrete will make many rocks. However, you must still do a thorough job of blending the ingredients in each bag and add water as instructed. If only a portion of a bag is needed, the entire dry contents must be poured into a container and thoroughly mixed first. Then, the portion needed may be measured and mixed with the correct proportion of water, and the mixture poured into the mold. This is very important because a portion taken directly from the sack will result in incorrect proportions of gravel, sand, and concrete. The rocks made from such a poor mixture will be soft, crumbly, and dangerous. Make sure all mixtures are in proper proportions (follow directions on the sack closely) to insure safe rocks.

If extra-strong rocks are necessary, one of the special formula packaged concretes may be utilized. Generally, these are referred to as "patching" concretes. These have latex, vinyl, or epoxy added which makes them stronger, but much more expensive.

Latex concrete is available in two forms. One form contains a can or box of cement powder and a can of the liquid latex which are mixed. Another form of latex concrete, as well as vinyl concrete, involves a box or sack of 5, 10, or 40 pounds of dry latex (or vinyl) to which only water is added. The directions on the box or sack should be followed closely.

Epoxy concrete consists of an epoxy resin, a hardener, and sand. The resin and hardener are packaged separately. They are all mixed together to make epoxy concrete. Epoxy concrete is the strongest choice, but is extremely expensive. Again, follow the directions carefully, work in a well-ventilated room, and do not let the compound come in direct contact with the skin.

Curing of any concrete mixture is very important. This is especially important with the conventional sacked premix because improper curing will yield weak, cracked, or "flakey" rocks. If latex, vinyl, or epoxy materials are used, then simply follow the directions. The latex type sets-up fast, so have the forms ready and be prepared to work quickly. When referring to curing within the context of this text, I am referring to the standard high density pre-mixed material that is sold in 40-80 pound sacks at hardware stores and lumber yards.

If only a portion of the pre-mixed concrete is used, the entire contents must be blended first in a separate container. Then the portion needed is measured and mixed. Read the directions on the sack carefully and follow them for proper curing.

For the most part, concrete should be poured within 45 minutes from the time it was mixed. Otherwise, curing begins and the concrete may become too thick to handle and will not fill the mold. Mix only as much as you can use within 45 minutes. Do not try to compensate by adding more

water; this will make the resultant concrete weak--follow directions. Pour the concrete into the mold and tap and shake the mold to insure that all the voids are filled and that there are no air pockets remaining. Time is important, so follow the directions carefully and strong rocks will result.

Curing involves the process of hydration, which is the hardening chemical reaction between the water and the cement and takes place over a long period of time. Generally, the longer the curing time, the harder the resulting concrete. This curing time requires about five days. It's very important to prevent the water from evaporating too quickly. This might mean covering or moistening the mixture at regular intervals. The concrete should not be covered for two to five hours, or before it can hold a scratch mark. If an "open" form is used, the exposed surface should be sprinkled with water after a 2-5 hour wait; then roll a plastic sheet over the surface and tack it down. After five days, the concrete will be ready to remove.

Weather is very important during the five day curing period. Temperature is especially critical; if the temperature is too hot, the cement will cure too fast; and if it's too cold, it will cure too slowly. Since the best temperature for curing is about $72^{o}F$, it is best to pour the concrete into the molds indoors where the temperature can be controlled. If the mixture must be poured outdoors, keep the molds in the shade.

Molds can be made in several ways. Among these methods are using a sand box and plastic bags, constructing fiberglass molds, constructing latex molds, and constructing molds from plywood and plastic sheets. Each method has its advantages and disadvantages and the person who is in charge of construction must weigh them carefully based upon the budgeted amount, the time available for construction, and how elaborate the wall is to be.

Regardless of what method of mold construction is used, all artificial rocks should have similar characteristics. For example, all rocks should be fist size or slightly larger. Making them too large wastes concrete and makes them cumbersome to place. Also, all artificial rocks should have some type of anchor placed in them. A 5/16 inch eyebolt works well because it will support a large load, will not twist inside the hardened rock when the rock is screwed into the wall, and will offer some reinforcement to the rock and prevent, to some extent, breakage. Also, all rocks should possess a flat surface at right angles to the anchor bolt. This is important because the rocks will need to be glued to the wall using one of the new glues that will be discussed later. All rocks should be anchored with both bolts and glue. In addition, rocks should be of "interesting" shapes. They should be irregular and "natural" looking, not bricks or blocks. The "eyes" of the eyebolts are placed inside the artificial rocks and do not protrude. If "eyes" were exposed, students would be tempted to place their fingers inside them and if a fall occurred, a serious finger injury would result. The finished rock (figure 29) should have an eyebolt anchor, preferably 5/16 inch, a flat surface

perpendicular to the anchor eyebolt for gluing to the wall, be of reasonable size, and have an interesting shape.

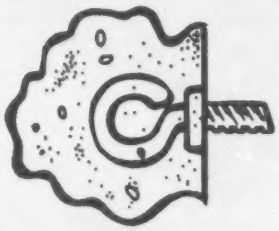
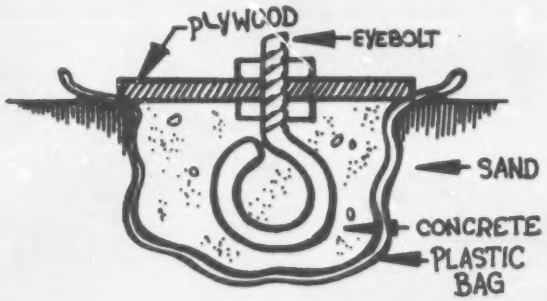


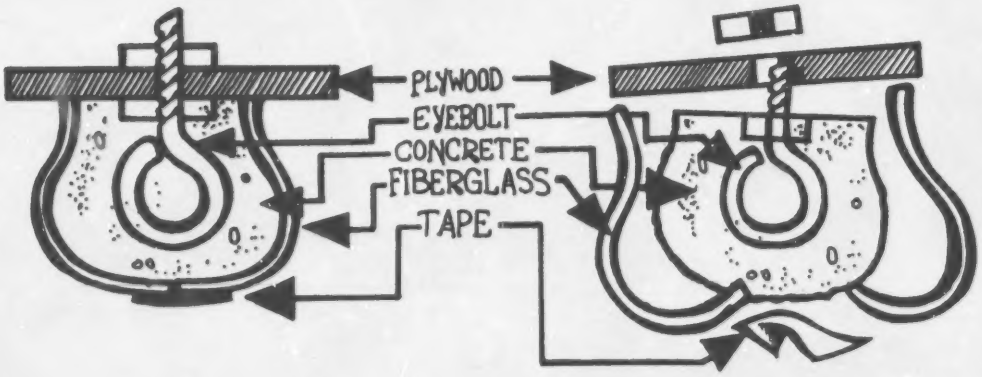
Figure 29: A cross-section of a typical manufactured rock for artificial climbing walls.

Any large sand area, although a large sandbox works best, could be used for making artificial rocks with plastic bags. The bag is simply filled with concrete and placed into a similarly sized hole in the sand. Then an eyebolt with a board fastened to it is immersed into the cement and allowed to dry. After curing, the completed rock is plucked from the sand and the board twisted off the shaft of the eyebolt and the plastic removed. Interesting rocks can be made this way very economically. However, it usually requires an outdoor area at the mercy of the weather and the shape of the rocks cannot be controlled effectively.



The fiberglass mold works well and is very durable. To make this mold, a good size natural rock with the desirable shape is selected. The rock is draped with fiberglass cloth and resin on the face side, which is the side facing away from the wall. The fiberglass and resin that is used for boat repairs works well. Care should be taken so that the edges are even to insure a flat surface for wall placement. When the fiberglass has hardened, the rock is removed. If the rock cannot be removed because the inside surface slants toward the middle (a desirable feature), then the mold is carefully sawed in half with a hacksaw. Once

the rock has been removed, the mold is taped together and is ready for use. To make the artificial rocks, the taped mold is completely filled with the cement mixture, an eyebolt is screwed into a piece of wood and placed on top of the mold with the eye of the eyebolt immersed in the cement mixture. After curing, the tape is pulled off the mold, the mold removed, and after curing, the rock is ready for placement.



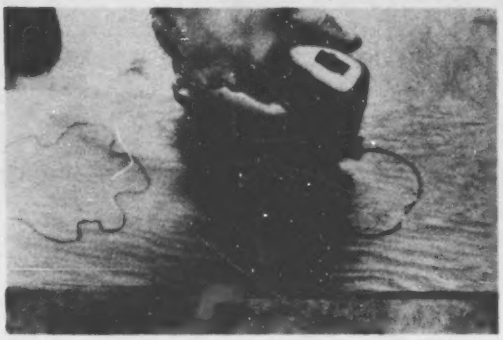
The most unique rocks can be made with latex molds. Unique, because they can be made into any three-dimensional shape desired, with indentations and grooves which can act as jambs and finger-holds. However, these molds are very difficult and expensive to make and should not be attempted unless you are experienced with plaster casting. It might be possible, however, to have a local statuette manufacturing firm make the molds.

The molds are made by first designing the rock from clay with indentations and grooves placed where desired. After drying, the clay rock is brushed with latex and allowed to dry; this is repeated until it is strong enough to support the cement rock. After the final coat has dried, the latex form is peeled from the clay rock and it is ready for use. The form might still require some support from the bottom when the cement is poured. Generally a "box" is used to support the entire construction with the eyebolt placed in a board before it is placed into the mold.

One of the quickest and most economical methods which yields unique rocks is the plastic-sheet-plywood method. By using this method, a variety of rocks can be made using the same mold. And, in this case, grooves and finger-jambs can be incorporated into the rocks easily. The major disadvantage of this method is that some planning is necessary, as well as plywood and disposable sheets of plastic.

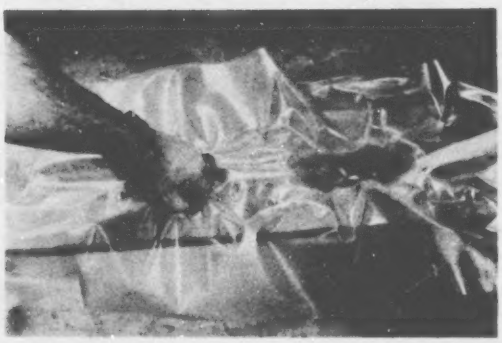
To construct the plastic-sheet-plywood mold, holes, the size of the desirable rocks, are cut through a 3/4-inch plywood spaced 4-5 inches

apart and in a row; generally a row of four or five per board are easiest to handle.

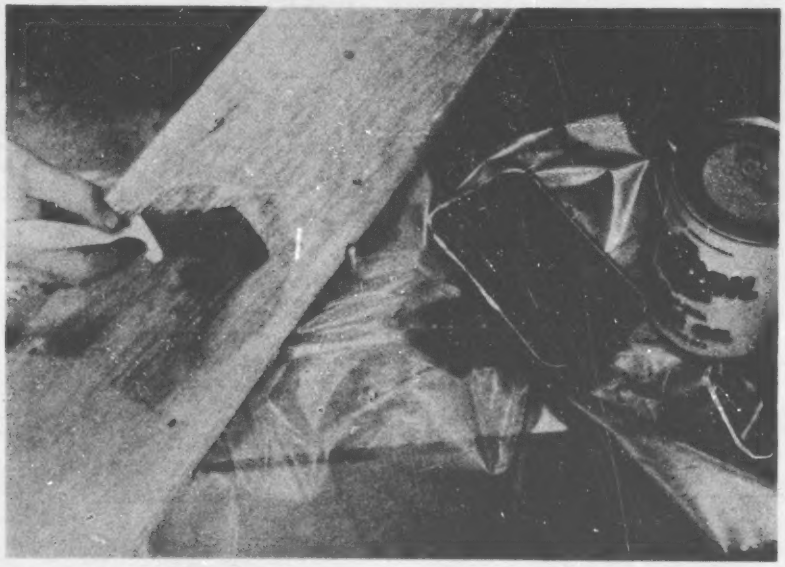


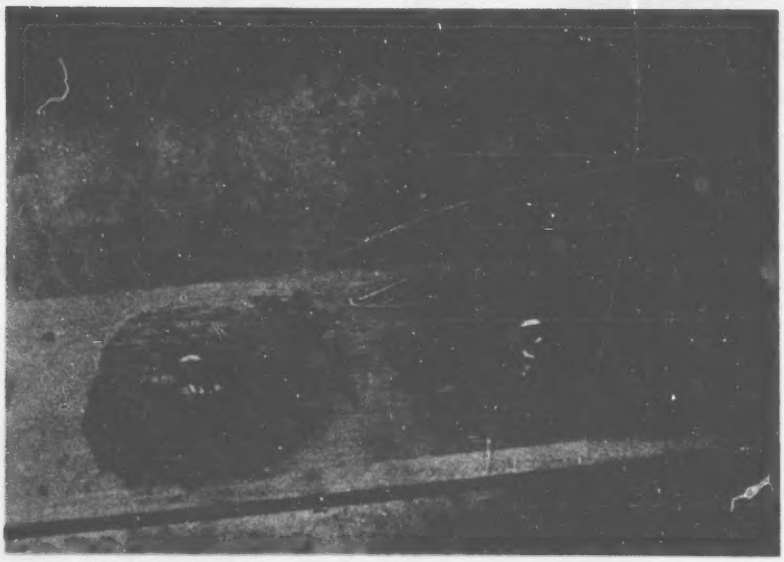
Another 3/4-inch plywood board is cut that can be placed on top of the board with the holes. It's important that the boards are equal in size since it will be easier to align them. Next, holes are drilled through both boards that will accommodate either 3/16-inch or ¼-inch bolts. The easiest way to do this is to clamp the boards together and bolt them together as the holes are drilled. There should be four bolts around each hole to insure sealing pressure. Then holes for the 5/16-inch eyebolts are drilled in the middle of each area where rocks will be formed. The unit is then disassembled and the plastic is installed.

Sheet plastic (the type purchased at lumber yards) is draped over the open mold. The rock size is developed by "fisting" the plastic into the mold, making sure it's at least large enough to accommodate the eyebolt. The clamp bolts are forced through the plastic to hold the plastic in place. The eyebolts are placed into the upper board and held stationary with nuts. The concrete is mixed and readied for the pouring process.

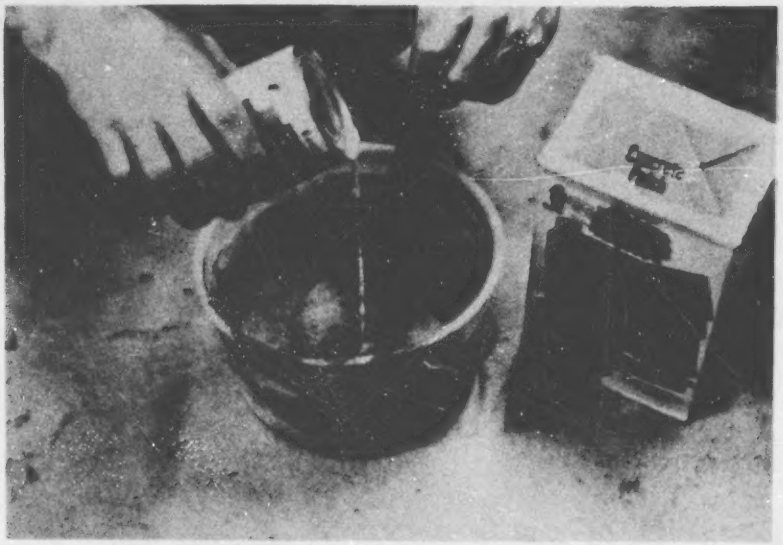


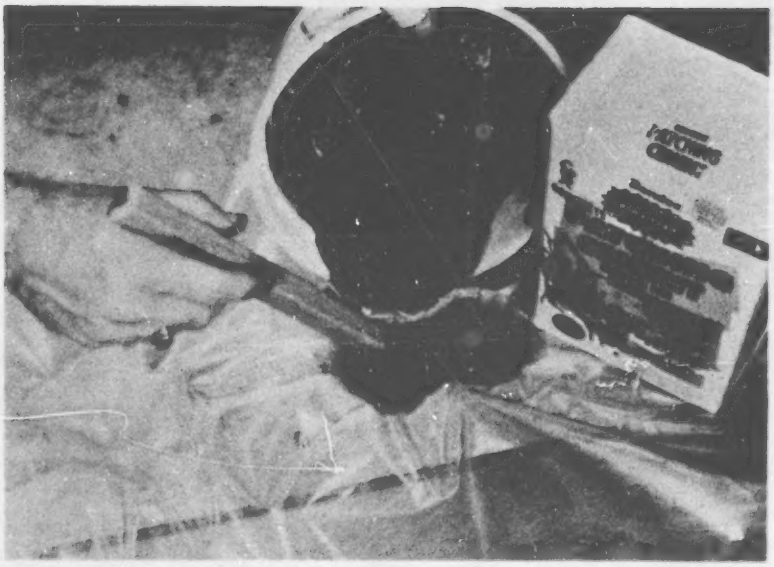
The upper-board now needs some special attention. Any areas where water might come into contact with the board should be painted with oil or kerosene. Clean motor oil works best because it has no offensive odor. However, kerosene is more economical. If this is not done, the rocks will be difficult to remove and the board will deteriorate quickly. The board will need to be re-oiled before each use and the plastic replaced. Now the cement can be prepared.



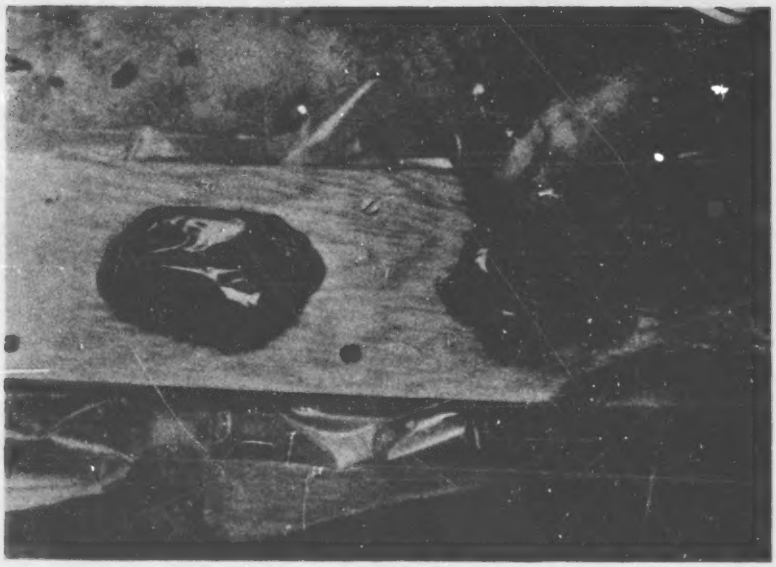


The mixed cement is poured into the molds. It is important that the molds are completely full. After pouring, the oiled board with the eyebolts in position are clamped in place.





After tightening the clamp bolts, the entire mold is turned upside down; this will insure a flat wall surface. The plastic surface can then be manipulated with grooves or holes for jambs. Something heavy with a sharp edge can be placed on the plastic to develop an interesting shape.



The mold should then be retired for curing in an area which has the appropriate temperature. There is a temptation to inspect the molds but it's best to leave them alone, or they will develop cracks, splits or chips. When the mold is filled and before it is turned over, it should look like figure 30.

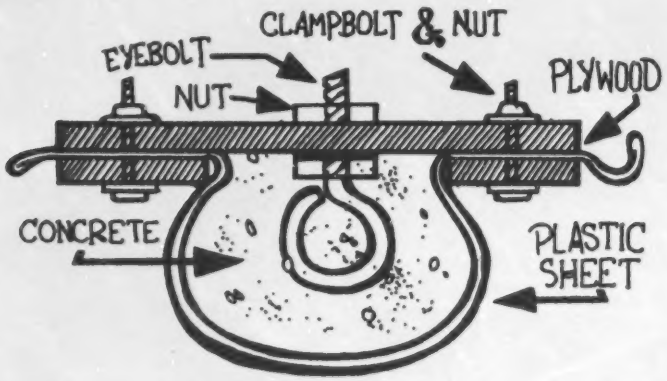
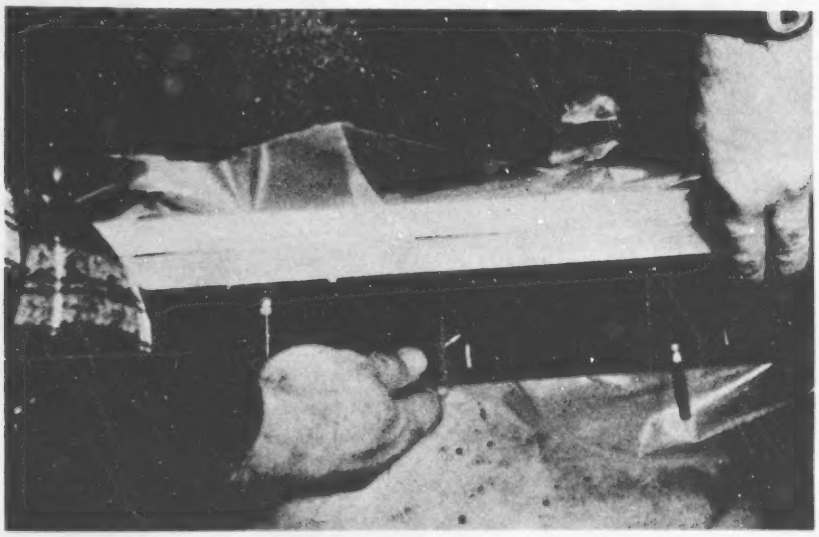
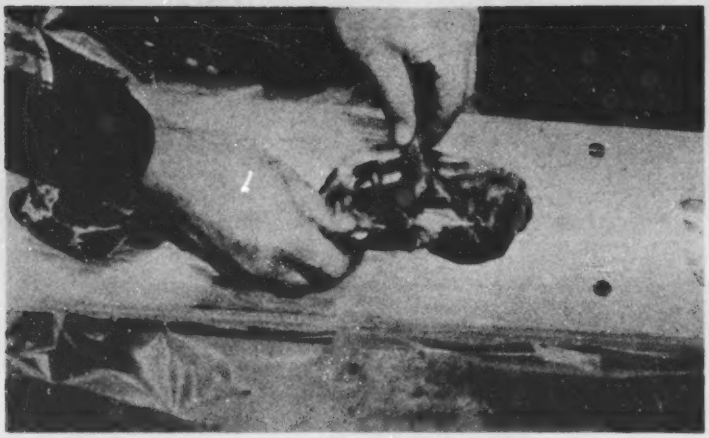


Figure 30: The plastic-sheet-plywood molding method.

After curing, the clamp bolts and outer eyebolt nuts are removed. The upper board is then removed and the plastic sheet cut around the rock. Now the rocks can be carefully removed through the bulged side. This bulge is important because it acts as the finger/foot-hold and therefore is an advantageous function of this mold.



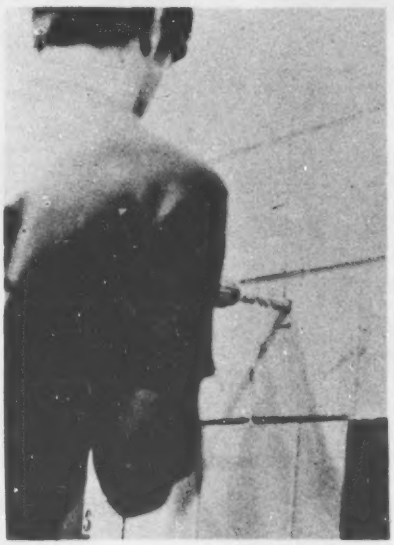


The rocks then need to "set" for about a week before attempting to place them on the wall. All rocks should be checked for cracks or other flaws. If any defects exist, they should be broken and discarded; the 3/8-inch eyebolt can be reused. The perfect rocks are now ready for installation.

To attach the rocks to the wall, anchors are placed into the wall and the glued rocks are screwed into place. One common problem is that it is impossible to predict which end of the rock will face up. So, the rock should be functional on all sides.

Regardless of what technique is used for manufacturing rocks, the anchoring process is the same.

First, a hole must be drilled. There are two methods that can be used to put a hole into concrete or mortar. One method uses a "star drill" which in reality isn't a drill at all, but a tool that chips out the concrete as it is pounded with a heavy hammer. The other method, which is quicker and easier, uses an electric drill with a special carbide-tipped bit, called a masonry drill. By using a 5/8-inch anchor, loads from 500 to 3,500 pounds can be maintained, depending upon the type of anchor and wall.



Drilling into mortar is quite easy, especially with a slow speed drill. Concrete, on the other hand, is more difficult to drill into and requires a great deal of pressure. However, care needs to be exercised to prevent rib injuries; the drill should not be placed against the rib cage.

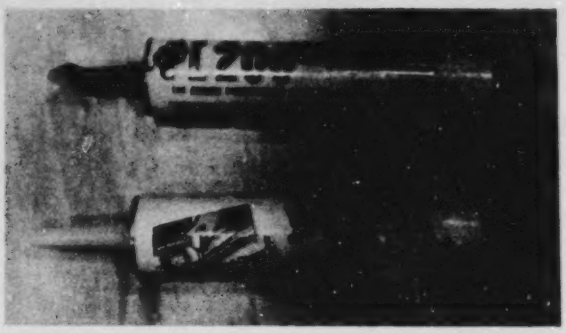
Once the hole has been drilled into the concrete or mortar, the dust will need to be blown out. The safest way to do this is to use a short piece of plastic or rubber tubing. Otherwise, there is a possibility of getting dust into the eyes if an attempt is made to blow directly into the hole. For all the drilling and anchoring procedures, safety glasses are essential.

It is easier to drill holes into mortar between the bricks than into the bricks themselves. With the proper anchors, the artificial rocks can be made as secure as needed, therefore drilling holes in bricks is not recommended.

It's also important that the hole be as deep as the full length of the screw/the anchor. Otherwise the anchor or bolt will not draw the rock tightly to the wall.

The fastener which works best with the 5/16-inch eyebolt is the machine-screw anchor, which is sometimes known as the "Ackerman-Johnson" anchor, named after the original manufacturer. It is made of a hard metal inner core which is threaded on the inside to accommodate the machine screw (eyebolt) and tapered at one end; the other part is a lead sleeve. A driving tool is needed to place this anchor. The anchor is screwed onto the tool and then placed in the hole with the tapered end inside the hole. Hammering on the end of the driving tool expands the lead sleeve over the tapered end of the hard inner core, forcing the anchor to lock sideways into the wall. The driving tool is then unscrewed from the anchor and an artificial rock can then be glued and screwed into its place. The machine-screw anchor, when properly placed, will hold more securely than any of the others.

Now the rocks are ready for gluing and placement. The wall and rocks need to be dry and clean; obviously, the rocks need to be totally "cured." A wire brush works fine for cleaning the rocks and the immediate wall surface surrounding the anchor. The B.F. Goodrich P L-200 and the Fuller Tan-Mastic work very well, but most any of the construction adhesives that are sold in tubes and applied with caulking guns will work.



When these glues are used, the area should be well ventilated and rubber gloves and safety glasses used. The glue dries quickly, so it is best to drill several holes and place several anchors, preferably an entire climb, before proceeding with the gluing process. To glue the rock, simply squirt a small amount of the glue on the wall-facing rock surface; do not use too much or it will leave a mess on the wall. Then quickly screw it into the appropriate anchor. Some glue will ooze out of the joint. A 3/4-inch dowel can be used to pull and move the glue to the open cracks and completely seal the rock to the wall (figure 31). Because the glue will tend to "run" to the bottom of the rock joint, it should be checked several times and resealed by using the dowel. Although the rock would probably be ready for use as soon as the glue hardens, it should not be used for two or three days to insure proper glue curing time. By bolting and gluing the rock, the resultant foot and handholds will offer an interesting and safe climbing experience.

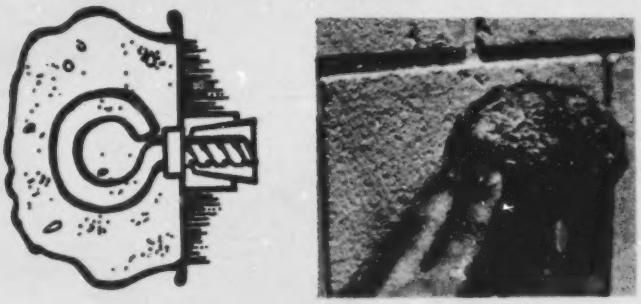
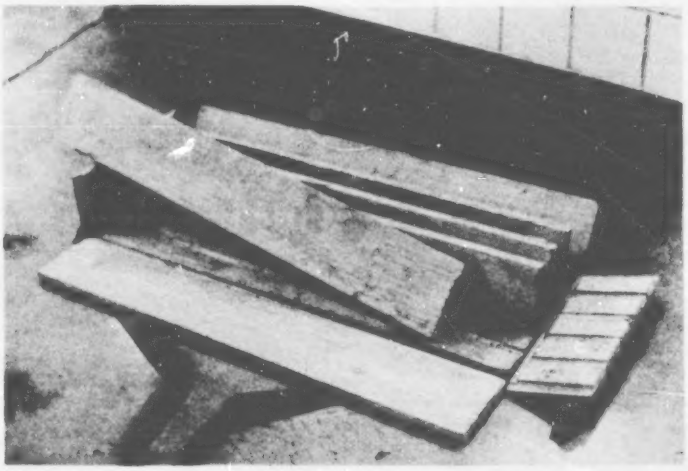


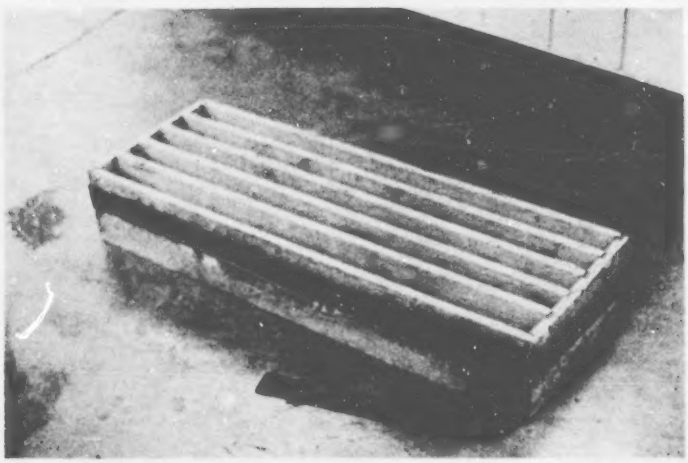
Figure 31: A cross-section of an artificial rock properly anchored and glued to the wall.

To develop a wall with layback, jamb and mantle climbs (as explained earlier), slabs of rock will need to be constructed and placed rigidly on the wall. These slabs are more difficult to make and place, so this aspect of the wall might best be left for last, after some basic experience with the rocks has been acquired.

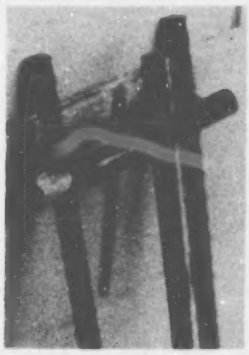
To make slabs, a mold must be constructed that will form the proper sized slabs. An iron reinforced skeleton will need to be welded for each slab. Several people will be necessary to place the slabs.

The mold is best made of 3/4-inch plywood and generally with several compartments so that four or five slabs can be poured at one time. The maximum size that can be handled efficiently is about 40" X 6" X 2". Remember to oil the form, otherwise the slabs will be difficult to remove and the form will be ruined.

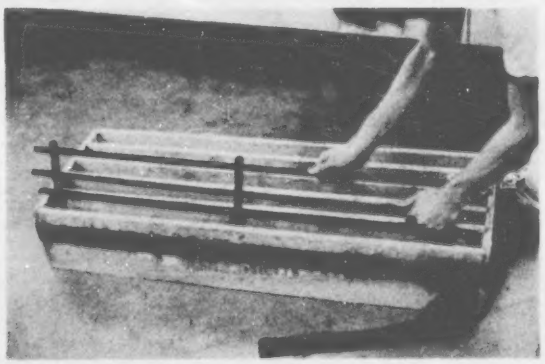




As previously mentioned, the slabs will need to be fortified with reinforcement rod and steel tubing. Half-inch concrete reinforcement rod and steel conduit with an inside diameter of ½-inch works well. Three pieces of tubing 6 inches long are "tack" welded to three pieces of reinforcement rod 39 inches long. One 6-inch piece of pipe is tacked in the middle and the two end pieces tacked about 3 inches from each near end. It might be advantageous to determine exactly where they go by measuring the mortar cracks in the wall.



Before placing the reinforcement skeleton in the form, the pipe (conduit) openings must be taped shut with masking tape. Then it is placed into the form and properly mixed concrete is poured into the mold.



It is necessary to make sure the form is completely filled and that the skeleton reinforcement rod is not exposed. This is accomplished by constant prodding around the skeleton while the concrete is poured; the mold can also be tapped to settle the concrete material.

Next, the mold and its contents should be placed where the temperature is constant and optimal and allowed to cure. Remember to review the process of maintaining some dampness on the concrete to insure proper curing. After the usual five days, the slabs are ready to be removed.

The slabs must be removed carefully or they will be broken. First

the form braces are released. Then the boards are lightly tapped and, if they were properly oiled, the boards will release and expose the slabs. Caution needs to be exercised because the slabs are very heavy. Staff and maintenance personnel should be the only people handling and placing the slabs because of the danger involved in handling the heavy weight. Now the wall needs to be marked for drilling.

Because three slab bolts (5/16" X 8") must be lined up with holes in the wall, special care needs to be exercised when drilling for anchor placement. A hole for the center bolt can be drilled and an anchor put approximately where the middle of the slab is to be placed. The slab is then put in place and bolted down with the center bolt. Glue is not used yet. The other holes now need to be marked.

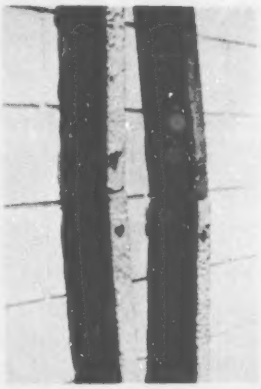
A ½" X 8" bolt is used to mark the anchor holes on the two ends. This bolt should be sharpened on the threaded end and the bolt is used as a center-punch. By inserting the bolt through the tubes and tapping it with a heavy hammer, an index mark will result that will indicate exactly where the anchor holes should be drilled. The slab is now turned 90^{0}, the holes drilled, and anchors placed. Now the slab is ready for final placement.

To secure the slab, the center bolt is removed while two other people are holding the ends of the slab, remembering that the slabs are very heavy. Glue is placed on the edge of the slab mated to the wall and anchors.

Then the slab is quickly placed in position and three 5/16" X 8" bolts with washers on them are used to draw the slab securely against the wall.

A dowel should be used to seal all the edges and to check any glue "running", as was done with the rocks.

The slabs can be placed in verticle columns, resting on one another, for jamb and layback climbs.



If a mantleshelf is desired, then another slab should be placed at right angles directly below it, "T" style, for additional support.

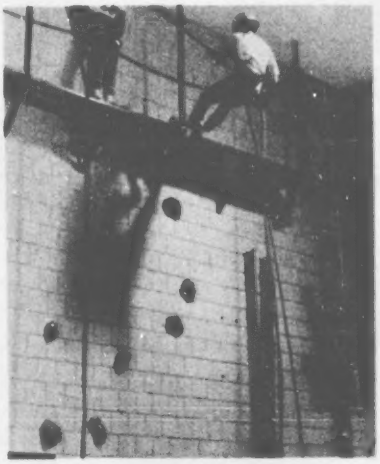
As previously mentioned, all stations need to be accessible in case of an emergency, such as a student being entangled with the break bar mechanism and the rope. Often, students can be talked through the difficulty; but if not, the student might need help as soon as possible. Herein lies the importance of the platform.

The platform also provides an area where the students can rest and gather their emotions or change equipment, and from which they can rappel. The platform, therefore, is a very functional part of the climbing wall as well as a safety back-up system. Constructing the platform is another endeavor that needs to be explored.

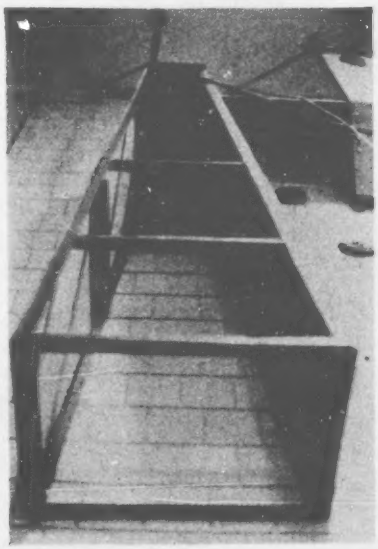
Basically, the platform braces are made of 1 3/4-inch X 1 3/4-inch quarter-inch angle iron that are welded at right angles and braced against

the wall. With three 2-inch X 6-inch planks placed across the braces, students will have an ample area to move. It is recommended that the fastening bolts pass entirely through the wall and the platform brace to insure stability. And these bolts should be at least 3/8 inches in diameter with two bolts per brace. It is also recommended that the braces be spaced three feet apart. That is, for an 18-foot span, seven braces would be required; this includes the extra brace necessary for one end.

Whenever the platform is erected, it should be as high as possible yet allow enough headroom for students to function well. This will provide for maximum wall usage.



Students climbing and rappelling. Note slabs constructed into a jamb-climbing station, the rock placement and the platform braces.



An emergency ladder, chimney climbing station, and "open book" climbing station can all be incorporated into one unit. This unit, made of 1½" X 1½" three-sixteenth inch angle iron and 3/4-inch high quality plywood which can be tapered at the top or bottom, or straight to provide the desired challenge. Chimney climbing is strenuous, so narrowing the top of the structure will make the climb easier. The same concept is true for the "open book" climb which can be placed opposite the chimney climbing area. The cross (horizontal) supporting bars between the structures make an ideal emergency ladder for the instructor to quickly reach the top.

If a tapered combination unit involving a ladder, chimney, and "open book" is contructed, it should be designed with a minimum of one-foot width at the top. Also the bottom needs to be high enough to prevent tempted students from climbing up the ladder or individuals from bumping their heads when they pass below the structure. The unit generally is not built from the floor for security and safety reasons and to save space in the room. Obviously a unit this large will be very heavy, therefore a small crew of adults will be required to fasten it (preferably with 3/8-inch bolts) through the wall.

Although it will eventually wear off, textured paint can be added to the wood to increase friction. Rocks can also be fastened easily to boards by drilling a 3/8-inch hole through the board, gluing the rock and fastening a washer and nut on the inside. It is important not to construct a unit that is too easy to climb; it should be challenging.

The anchors that will support the belays and rappel ropes are most important because they are the final back-up anchors. These should be 5/8-inch eyebolts either bolted through the wall, through the beam, or fused to the beam by a competent welder. Carabiners are not used to attach ropes to these anchors. Instead, the ropes are threaded directly through the eyebolts. This eliminates the possibility of students' "unsnapping" anchors. This method will allow the belay ropes to "feed" properly through the eyebolts and yet eliminate the need for additional, expensive carabiners.

Rappel ropes are knotted together at the top, next to the eyebolt, with an overhand knot, to insure against falls if a student mistakenly rappels with only one rope. All rappels are belayed from a different anchor. These techniques provide additional security for rappelling.

When students reach the top, there should be someplace for them to anchor. In the sample wall design used throughout this text, the anchor was a horizontal rope with each end attached to anchors at the opposite ends of the platform. After reaching the top, the student simply "snaps" onto the horizontal rope with a locking carabiner before going off belay. Then the student may walk to the rappelling station, protected by the "gliding" carabiner. Students need to be reminded to go on belay before snapping off the rope anchor. Remember, students are always on belay or anchored when on the wall.

To secure all the ropes when the climbing wall is not in use is a very simple procedure. First, all the ropes are tied together, close to their ends, with one of the middle belays. Then, the other end of the belay rope is pulled until all ropes are up to the ceiling and inaccessible, and the belay tied high on the emergency ladder or other difficult-to-reach structure. When climbing is to resume, the belay is simply untied and the rope cluster lowered. This is a quick, easy and safe method of securing the ropes.

Once a climbing wall is constructed, the instructor may be tempted to

teach the climbing skills on the wall and neglect an outdoor climb. The climbing wall is only intended to be a teaching aid and not to supplant an outdoor adventure. If at all possible, an outdoor climb should be scheduled.

Whether an outdoor climb and/or a climbing wall is utilized, a record sheet (page 99) is a good recording and motivational tool. This can be used to describe the climb, the climbs difficulty, the rules, and places to record up-climbs, down-climbs, and rappels. A certificate (page 101) is also a nice item for students to take with them, provided they have performed safely and appropriately.

A climbing wall will prove to be a very satisfying and functional project that will give years of service while providing an ideal teaching situation.

ADVANCED INSTRUCTION OPPORTUNITIES

An aspiring climbing instructor will naturally desire the best possible training for himself. And, as indicated at the onset, this text is not intended to supply instructor instruction, but to act as an instructional guide. Also, once engaged in teaching rock climbing, the instructor will become inspired to learn more advanced techniques. Herein lies the importance of private schools and public institutions which offer programs in rock climbing. A mountaineering experience involving rock climbing will develop insight and wisdom which no text can provide.

Techniques used by the private schools and public institutions may vary from those suggested in this text; the schools will generally use techniques they have found successful, ones they have developed, or techniques based on newly developed equipment. Remember that these techniques will be based on very small group sessions conducted during flexible periods of time, a luxury not often found in the public schools. However, the aspiring instructor should always be open to new techniques based on new equipment and research findings, especially when they will enhance safety.

Listed here are private climbing schools and clubs that offer practical rock climbing instruction; schools which emphasize snow and ice climbing are not listed. Most schools offer beginner through advanced programs and costs range from $15.00 to several hundred dollars per session depending upon the program, equipment provided, and selected climb. No attempt is made to critique or endorse any of the programs; however, when contacting a school, be sure to ask for references. Most schools have been in existence for some time and have good reputations and outstanding instructors.

Alpine Crafts Ltd.
Box 85697
North Vancouver, British Columbia
Canada

Appalachian Climbing School
Mountaineering South, Inc.
344 Tunnel Road
Asheville, North Carolina 28805

Appalachian Mountain Club
5 Joy Street
Boston, Massachusetts 02108

Arizona Mountaineering Club
c/o Bob Coraf
8418 East Roanoke Avenue
Scottsdale, Arizona 85257

Base Camp Climbing School
121 North Mole Street
Philadelphia, Pennsylvania 19102

Blazed/Trail Climbing School, The
Abercrombie & Fitch
360 Madison Avenue
New York, New York 10017

Bob Culp Climbing School
1329 Broadway
Boulder, Colorado 80302

Camper's Corner
2050 Elvis Presley Boulevard
Memphis, Tennessee 38106

Canadian School of Mountaineering Ltd.
P.O. Box 1552
Banff, Alberta TOL OCO
Canada

Climb High, Inc., Mountaineering School
227 Main Street
Burlington, Vermont 05401

Colorado Mountain School
2402 Dotsero Avenue
Loveland, Colorado 80537

Dartmouth Outward Bound Center
Box 50
Hanover, New Hampshire 03755

Eastern Mountain Sports Climbing School
Main Street
North Conway, New Hampshire 03860

EE-DA-HOW Mountaineering and Guide Service
P.O. Box 207
Ucon, Idaho 83454

Exum Mountain Guide Service and School of American Mountaineering
Moose, Wyoming 93012

Fantasy Ridge School of Alpinism
Box 2106
Estes Park, Colorado 80517

Forward School of Mountaineering, The
1432 Tweed Street
Colorado Springs, Colorado 80909

Harvey T. Carter Climbing School
Box 962
Aspen, Colorado 81611

Herbert Cretton Rocky Mountain Climbing School and Guide Service
Box 769
Estes Park, Colorado 80517

High Adventure Techniques
62 Livingston Avenue
Dobbs Ferry, New York 10522

High Ways
Box 1744
Boulder, Colorado 80302

Institute of Mountain Education
P.O. Box 336
Eldorado Springs, Colorado 80025

International Mountain Equipment, Inc.
Main Street
Box 494
North Conway, New Hampshire 03860

Iowa Mountaineers
P.O. Box 163
Iowa City, Iowa 52240

Jackson Hole Mountain Guides
Teton Village, Wyoming 83025

Mazamas
909 Northwest 19th Street
Portland, Oregon 97209

Mount Whitney Guide Service and Sierra Nevada School of Mountaineering
P.O. Box 659
Lone Pine, California 93545

Mountain Affair Mountaineering School
Idyllwild Mountaineering Institute
54414 North Circle Drive
P.O. Box 369
Idyllwild, California 92349

Mountain Craft
P.O. Box 622
Davis, California 95616

Mountaineering School of Vail, Inc.
P.O. Box 931
Vail, Colorado 81657

Mountaineers, The
719 Pike Street
Seattle, Washington 98107

National Outdoor Leadership School
P.O. Box AA
Lander, Wyoming 82520

Nord Alp, Inc.
3260 Main Street
Buffalo, New York 14214

North Country Mountaineering, Inc.
P.O. Box 951
Hanover, New Hampshire 03755

Outdoor Leadership Training Seminars
2200 Birch Street
Denver, Colorado 80207

Palisade School of Mountaineering
1398 Solano Avenue
Albany, California 94706

Potomac Valley Climbing School, Inc.
P.O. Box 5622
Washington, D.C. 20016

Recreation Unlimited
Jackson, Wyoming 83001

Rockcraft
609 Durant Street
Modesto, California 95350

Rudi Gertsch Mountaineering School
Box 543
Banff, Alberta TOL OCO
Canada

Sawtooth Mountaineering, Inc.
5200 Fairview Avenue Mini Mall
Boise, Idaho 83704

Sierra Club, The
Rock-Climbing Section, San Francisco Chapter
c/o Vern Muhr, Chairman
6500 Tremont Street
Oakland, California 94609

Telluride Mountaineering School
Box 4
Aspen, Colorado 81611

Too Distant Horizon Climbing School
3401 Valley View Drive
Morietia, Georgia 33006

Wolfcreek Wilderness
P.O. Box 596
Blairsville, Georgia 30512

Yosemite Mountaineering
Yosemite, California 95389

A delightful way to spend a summer is to receive academic credit for completing a college or university climbing course. Some of the courses are offered by the private schools listed above. Cost obviously varies with the program content, so it is recommended that prospective students contact the registrar's office of the institution(s) in which they are interested. This list is not an endorsement, but most of the programs are well developed.

Memphis State University
Continuing Education Department
Memphis, Tennessee 38111

Missouri Western College
St. Joseph, Missouri 64506

Northern Arizona University
Flagstaff, Arizona 86001

Olympic College
Bremerton, Washington 98310

Outward Bound, Inc.
National Headquarters
165 West Putnam Avenue
Greenwich, Connecticut 06830

Plymouth State College
Plymouth, New Hampshire 03264

Prescott College
Challenge/Discovery
Prescott, Arizona 86301

State University College at Potsdam
Wilderness Workshop
English Department
Potsdam, New York 13676

Ulster Community College of the State University of New York
Stone Ridge, New York 12484

University of Colorado
Boulder, Colorado 80302

University of Iowa
The Iowa Mountaineers
P.O. Box 163
Iowa City, Iowa 52240

University of Southern California
Los Angeles, California 90007

University of Utah
Salt Lake City, Utah 84112

Washington State University
Pullman, Washington 99163

ANNOTATED BIBLIOGRAPHY

Books

Aleith, R. C. Bergsteigen--Basic Rock Climbing. New York: Charles Scribner's Sons, 1975. This is one of the most up-to-date books on all aspects of rock climbing. Aleith clearly discusses and graphically explains the importance of the climber's body and foot angle on the climbing surface, which is an essential prerequisite for rock climbing.

Bunting, James. Leisureguides Climbing. New York: Thomas Y. Crowell Company, 1973. This is a good "all-around" mountaineering book that includes the important aspects of orienteering and map reading. The introduction includes a brief but interesting history of rock climbing.

Department of the Army Field Manual. Mountain Operations. Washington D.C.: Department of the Army, 1964. The unique aspects of this manual is that it contains many methods of utilizing rope courses, methods of transporting material, and injured victim evacuation. This is a very complete text that could be utilized by the climbing instructor; however, the reader should realize the material is presented in a regimented military fashion. Can be obtained free from most army recruiters.

Dezettel, Louis M. Do-it-Yourself With Packaged Concrete and Mortar. New Augusta, Indiana: Editors and Engineers, Ltd., 1968. This is a very easy to read and understand booklet that would be very useful for artifical wall building.

Griffin, Larry. Practice Climbing. Englewood, Colorado: Pronto Print, 1973. This is a very small (16 page) pamphlet that includes some very brief recommendations that would be useful to the beginner. It might be a good text for students in that it is brief and economical.

Mandolf, Henry I. Basic Mountaineering. San Diego, California: Neyenesch Printers, 1974. The San Diego chapter of the Sierra Club has once more printed an excellent manual for outdoor use. The book contains an excellent section of first aid and survival for mountaineers.

Manning, Harvey, Chairman of Editors. Mountaineering, Freedom of the Hills. Binghamton, New York: Vail-Ballou Press, Inc. This text is often and correctly referred to as the "climber's Bible." The book contains about 500 pages on all facets of climbing and should be the instructor's first literary purchase; it is an excellent resource. Included is information on equipment, food, travel, belaying techniques, rappelling techniques, safety and food/meal information. This book is expensive, but is well worth the price.

Mariner, Wastl. Mountain Rescue Techniques. Binghamton, New York: Vail-Ballou Press, Inc. Although this is a technical text, a climbing instructor should be briefed on rescue methodology before engaging in any outdoor climbing. Depending on the ability of the class, this book could be used to help instruct a portion of the rock climbing survival unit.

Meldrum, Kim and Royle, Brian. Artificial Climbing Walls. London, W.C. 1: Pelham Books Ltd., 1970. An exciting book on the new age of rock climbing walls. England has had artificial climbing for some years, but is a recent innovation in America. Anyone wishing to build such a structure would find this text most informative.

M.I.T. Outing Club. Fundamentals of Rock Climbing. Cambridge, Massachusetts: Massachusetts Institute of Technology, 1971. This manual is in easy-to-read form that would make it functional in the school library for student use or perhaps as a text in class. The knot tying section is large and easy to understand.

Paulcle/Dumler. Translated from German by E. Noel Bowman, F.R.G.S. Hazards in Mountaineering. New York: Oxford University Press, 1973. This book covers many of the mountaineering hazards, particularly those involved with snow/ice climbing and skiing. Included is an excellent section on rock climbing. Rock formation hazards, weather, and lightning are covered in detail.

Perrin, Alwyn T., Editor. Explorers Ltd. Source Book. New York: Harper & Row Publishers, Inc., 1977. Although rock climbing is only a small part of this book, any climber would enjoy reading about the many sources of outing equipment and critiques. Included in the chapter on wilderness travel are pathfinding, travel by land, travel by water, travel in winter, provisioning in the field, and living in the field. Other chapters include sea travel, air travel, emergencies, vagabonding, and exploring.

Petzoldt, Paul. Petzoldt's Teton Trails. Salt Lake City, Utah: Wasatch Publishers, Inc., 1976. Although this book is more of a Teton trail guide, every potential rock climber should read Paul's stories. Petzoldt's description of his first Grand Teton climb is most humorous, revealing and enlightening.

Robbins, Royal. Advanced Rockcraft. Glendale, California: La Siesta Press, 1973. As the title implies, this small book is intended for advanced work. The text, however, includes material that an instructor could use, such as how to place chocks, placing chock oppositions, chock removal, use of runners (loops) with chocks, nesting pitons, jumar use, descender use, and tying the grapevine knot as well as safety hints which the instructor of a novice group will find beneficial.

Schneider, Anne and Schneider, Steven. The Climber's Sourcebook. Garden City, New York: Anchor Press/Doubleday, 1976. A large (340 pages) book which contains sources for every rock climbing need. Chapters include: where to learn to climb, technical mountaineering equipment, climbing equipment retail stores, technical rock and ice-climbing areas and local guidebooks, and mountain media.

Smith, George Allan. Introduction to Mountaineering. Cranbury, New Jersey: A.S. Barnes and Co., Inc. 1967. Although Smith's equipment, methodology, and techniques might be questionable, his chapters on photography, climbing organizations and book reviews are excellent.

Tyndall, John. Mountaineering in 1861. London: Longman, Green, Longman and Roberts, 1862. This is a historic book which describes the author's climbing experience in the Swiss Alps. The book is written in dramatic and descriptive terms and is a good text on past methods of moutaineering. The book offers no aid in teaching, however.

Wheelock, Walt. Ropes, Knots and Slings for Climbers. Glendale, California: La Siesta Press, 1967. Wheelock includes all the necessary information relative to ropes, slings and techniques of knot tying. Any doubt as to how a knot should be tied would be clarified by this text.

Wilkerson, James A., M.D., Editor. Medicine for Mountaineering. Revised edition. Binghamton, New York: Vail-Ballou Press, Inc., 1977. Written by climber-physicians, this text is a must for any climber instructor. This is the first book that refers to medical treatment, as distinguished from first aid. About 300 pages.

Magazines

Crenshaw, Jene M. and Kilness, H.V.J., Co-publishers and Editors. Summit. Editorial Office: P.O. Box 1889, Big Bear Lake, California, 92315. The magazine is similar to Ascent, however Summit concentrates on climbs in the United States and the rest of North America. Also included is a section on new book reviews, new equipment and a list of climbing guides.

Downer, Gene, Editor and Publisher. Teton. Editorial Office: Box 1903, Jackson, Wyoming 83001. Published twice annually, this magazine covers all recreational endeavors encountered in the Jackson Hole

area. Inasmuch as there are many rock climbers and mountaineers that frequent this habitat, a major portion of the magazine is dedicated to climbing. Photography is excellent and the magaizine also lists guide services and places to lodge.

Kemsley, William Jr. Backpacker. Editorial Office: 28 West 44th Street, New York, New York 10036. Although this magazine covers climbing, mountaineering, backpacking, camping, survival, and photography, it does not do so superficially. Most of the articles and photography are highly informative. The equipment evaluation section is the most valuable. All similar outdoor equipment is objectively evaluated and rated. A recipe and guide's section is also good.

Sierra Club. Ascent. Editorial Office: 6201 Medau Place, Oakland, California 94611. A remarkable magazine, covering all the major climbs around the world and featuring famous contemporary climbers. The photography is breathtaking, articles interesting and book reviews informative.

Relevant Studies

Davis, Robert W. The fear experienced in rock climbing and its influence upon future self-actualization. Doctoral dissertation, University of Southern California, 1972. One of the few studies that have focused primarily upon rock climbing and its benefits. Any proponent of climbing should read this revealing dissertation.

Golants and Burton I. Avoidance Response to the Risk Environment. Natural hazard research working paper No. 6. Toronto: Department of Geography, University of Toronto, 1969. This interesting article describes psychological changes that may occur as a result of overcoming risks and hazards in the natural and man-made environment.

Ittelson, W.; Proshansky; Rivlin L.; Winkel, G. An Introduction to Environmental Psychology. New York, New York: Holt, Rinehart and Winston, Inc., 1974. A text that is involved with the concept of environmental influences. The historic as well as man-made and natural environemtal phenomena are investigated.

Koepke, Sharon. The effect of Outward Bound participation upon anxiety and self-concept. Master's Thesis, Pennsylvania State University, 1972. Another interesting study regarding self-concept and actualization improvement through outdoor adventure programs. This study, however, is not limited to rock climbing.

Smith, Mary L.; Gabriel, Roy; Schott, James; and Padia, William L. Evaluation of the Effects of Outward Bound. Boulder, Colorado: Bureau of Educational Field Service, School of Education, University of Colorado, 1975. One of the most comprehensive and revealing studies of the Outward Bound program involving 600 subjects. Surely worthy of investigation.

Other Informative Information

Often times information can be procured from other resources. Commercial firms are generally happy to fulfill this obligation and below are just several that have been found particularly valuable.

Furst, Roger, Editor. Eastern Mountain Sports (EMS). Editorial Office: 1047 Commonwealth Avenue, Boston, Massachusetts 02215. This company has extensively tested climbing gear and reported the results in technical terms in their catalog. The catalog also covers important aspects of selection/maintenence of all equipment,

including boots and ropes.

Penberthy, Larry, Editor. Mountain Safety Research (MSR) Newsletter and Catalog. Editorial Office: 631 South 96th Street, Seattle, Washington 98108. This is one of the most thorough equipment testing organizations known. Lately they have been doing much work in physiology and climbing. As a result of their many years of testing, they now manufacture some climbing equipment.

Summary

As with any new endeavor, the success of a rock climbing unit will depend upon planning, patience, simplicity, and foresight. This manual has attempted to state the disadvantages of beginning such an activity as well as the advantages. Time judges all programs and the success of a rock climbing unit will be indicative of the number of student participants and the lack of student injuries. Hopefully, this material will aid the instructor in his quest to achieve these goals. Off Belay.

APPENDIX

PARENTAL PERMISSION FORM

Dear Parent,

On (date) your son/daughter will be accompanying (name of class) on a rock climbing field trip to (location). The students will be engaged in climbing and rappelling activities. The students will be belayed (protected from a serious fall by an attached rope) while climbing and rappelling. They will also be required to wear helmets while climbing, rappelling, and belaying. The students who are belaying will also be anchored (tied down with a rope attached to a permanent achor). If you have any questions, please call my office (phone number) at (time).

Thank you.

(Instructors name)

Yes, my son/daughter (name) has my permission to attend the rock climbing field trip on (date).

Signed:

_____

STUDENT CHECK SHEET

STUDENT NAME:

1. Exercises
2. 3-point slab climb
3. 3-point wall climb
4. Friction climbing
   a. Up frontwards
   b. Down frontwards
   c. Up backwards
   d. Down backwards
   e. Traversing
5. Rope coiling
6. Webbing tie
7. Overhand loop
8. Overhand follow-through
9. Tying in with overhand follow-through
10. Bowline around self
11. Bowline around object
12. Figure "8" follow-through
13. Figure "8" loop
14. Clove hitch
15. Swami belt
16. Leg loop harness
17. Belaying
18. Signals
19. Climb and belay #1
20. Climb and belay #2
21. Climb and belay #3
22. Climb and belay #4
23. Climb and belay #5
24. Climb and belay #6
25. Walk rappel
26. Outing rappel-high anchor
27. Outing rappel-low anchor
28. Self-evaluation
29. Final written test
30. Final grade

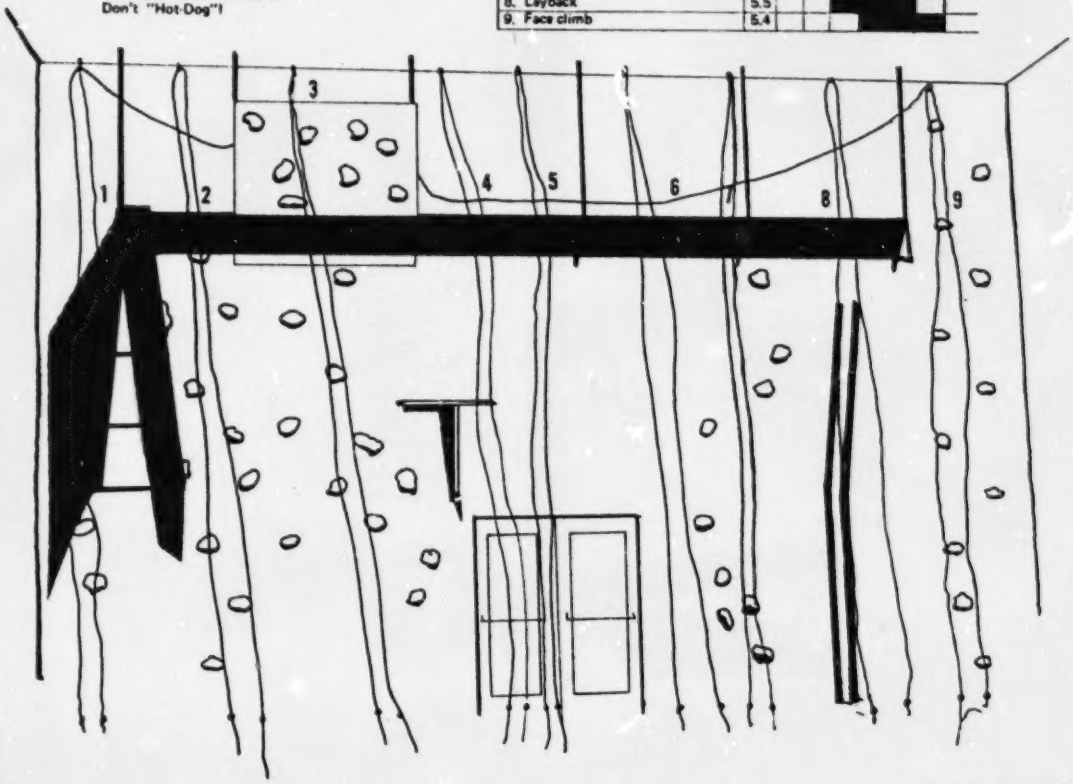
CLIMBING RECORD CARD (SHEET)

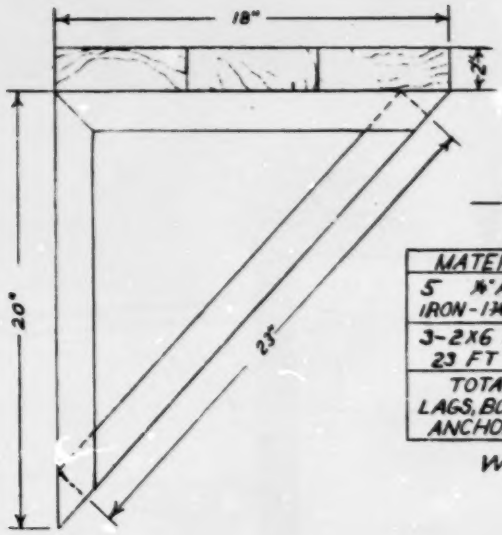
Name _____

Rules

You *must* be supervised to climb.
All knots should be double-checked.
Wear helmet when climbing.
All belayers *must* be anchored.
All climbers must be anchored or on belay.
Use the 3-point rule when climbing.
Snap in on rope at top before getting off belay.
Do not open locking carabiners at top.
Use proper signals.
All rappels must be belayed.
Don't "Hot-Dog"!

	Difficulty	Up-Climb	Down-Climb	Belay	Belay-Stitch	Belay-Fig. 8	Belay Spring
1. Chimney climb	5.2						
2. Open book climb	5.1						
3. Overhang climb	5.3						
4. Mantle climb	5.3						
5. Rappel-Figure 8							
6. Face climb	5.4						
7. Rappel-break bar							
8. Jam	5.6						
8. Layback	5.5						
9. Face climb	5.4						



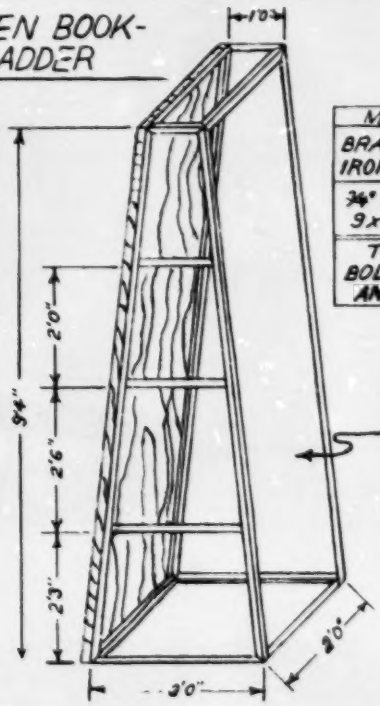


PLATFORM

MATERIALS	COST
5 ¾" ANGLE IRON - 1¾" X 1¾"	26'-8¾/ft. $21.88
3-2X6 PLANK 23 FT	23'-88¢/ft $20.36
TOTAL - W/O LAGS, BOLTS, AND ANCHORS	$42.24

WT. = 85 LBS.

CHIMNEY - OPEN BOOK - EMERGENCY LADDER



MATERIALS	COST
BRACES-¾" ANGLE IRON-1½x1½ - 5'	$27.54 5¢/ft.
¾" PLYWOOD 9x2 - 2 SHEETS	$29.76 14¢8/SL
TOTAL - W/O BOLTS, LAGS, AND ANCHORS	$57.30

WT. = 95 LBS.

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Mayo High School

·CLIMBING CERTIFICATE·

THIS IS TO CERTIFY THAT

_____

HAS SUCCESSFULLY COMPLETED THE BEGINNING ROCK CLIMBING COURSE AND HAS DEMONSTRATED PROFICIENCY WITH THE TRADITIONAL, STITCH, AND FIGURE "8" DESCENDER BELAYS. THE ABOVE HAS ALSO DEMONSTRATED ADEQUATE SKILLS FOR FACE, JAM, LAYBACK, OPEN BOOK, CHIMNEY, AND OVERHAND CLIMBS IN THE CLASS FIVE RANGE, AS WELL AS RAPPELLING WITH THE BRAKE BAR AND FIGURE "8" DESCENDER.

INSTRUCTOR_____

DATE_____

ROCK CLIMBING--TEST

NAME_____

I. TRUE or FALSE

T F 1. Modern climbing ropes are made of hemp.

T F 2. The looped webbing around your waist is called a swami belt.

T F 3. It is a good idea to break in rope by walking on it.

T F 4. Metal driven into the rock are called carabiners.

T F 5. It is proper for the climber to hold onto the rope when climbing.

T F 6. You rappel while wearing a seat sling or diaper.

T F 7. Traversing is a quick method of going down the side of a mountain.

T F 8. A 4.6 climb usually requires the use of a piton by the lead climber.

T F 9. "Falling" is a common climbing call heard in the environmental class.

T F 10. A Gold-Line is usually rated at 500 pounds.

II. MULTIPLE CHOICE

_____1. When rappelling you should have (a) helmet (b) belay
(c) seat sling/diaper (d) all the above

_____2. When rappelling, what produces the friction?
(a) brake bar (b) piton (c) prusik (d) none of these

_____3. The safety line is referred to as (a) belay line (b) rappel line
(c) seat sling (d) tow rope (e) piton

_____4. If you're very afraid of heights, you should
(a) try anyway--don't be chicken
(b) don't try, it may cost you your life!
(c) hang out a third story window by your fingertips to acclimate yourself to heights.

_____5. In climbing, when you move your right hand:
(a) your left hand should be well supported
(b) your left leg should be well supported
(c) your right leg should be well supported
(d) all of the above usually
(e) any combination of the above two (a-b-c)

_____6. Sliding down the rope: (a) belaying (b) conjectoring (c) reliefing (d) rappelling (e) carabinering

_____7. Usually driven into rock cracks for safety or supports: (a) Swiss chisels (b) ice screws (c) ice axe (d) pitons (e) impossible: rocks are too hard

_____8. Snaps commonly used in climbing: (a) seat sling (b) harness strap (c) farmer carrier (d) swiss seat (e) carabiner

_____9. Most commonly used rope in mountain climbing: (a) "Gold-Line" (b) hemp (c) cotton (d) flax (e) any line that doesn't stretch

_____10. Used in mechanical rappelling: (a) brake bar (b) carabiner (c) rope (d) Swiss seat (e) all of the above

_____11. Which type of rock formations are hard to climb because they crumble? (a) metamorphic (b) igneous (c) sedimentary (d) weird (e) any of the above if too soft

_____12. Most climbing boots: (a) have smooth bottom (b) have vibram soles (c) have no special features (d) must come as high as calves (e) must be waterproof

_____13. Which is used for direct aid climbing only? (a) pitons (b) carabiner (c) stirrups (d) diaper (e) rappel harness

_____14. Climbers usually use this type of support: (a) 1 point (b) 2 point (c) 3 point (d) 4 point

_____15. For probing on rock it is best to have (a) narrow welt (b) wide welt (c) burned welt (d) felt welt

_____16. Which puts more strain on muscles? (a) toe support (b) side foot support (c) they are the same

_____17. When traversing you should: (a) shuffle (b) cross-over (c) skip (d) hop

_____18. The person on the end of the rope securing the climber is: (a) rappeller (b) security guard (c) climber watcher (d) belayer (e) prusik

III. COMPLETION

1. Place the commands in the correct sequential order.

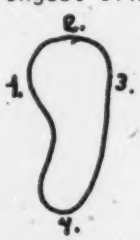
climber	belayer	
1.	2.	
3.	4.	
after a successful climb;		
5.	6.	

a. climbing
b. is belay on?
c. off belay
d. belay is off
e. climb
f. belay is on

2. Circle the best boot for climbing. (end view)

3. Circle the hand that does not come off the rope when belaying.

4. Circle the strongest climbing part of the foot.



5. What do these calls <u>mean</u> and <u>who</u> gives them?

a. slack

b. belay off

c. rope

d. climb

e. is belay on?